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THE INTERPRETATION OF ELECTROCARDIOGRAMS*

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Nearly one hundred years ago, it was discovered that with each beat of the frog's heart, a change in electrical potential resulted which could be recorded. Not until 1887 was it possible to make such records of the human heart. At that time Waller, using an instrument termed the capillary electrometer, showed variations in the level of a mercury column, caused by the human heart beat. The instrument was not connected with the heart, but to various parts of the surface of the body, which showed a potential difference due to cardiac contraction. While it was possible to record photographically changes in the level of the mercury column, the inertia of the column was so great that only gross changes were discernible.

In 1903, the introduction of an extremely sensitive "string galvanometer" by Einthoven, made practicable the recording of human electrocardiograms. In recent years vacuum tube amplification has permitted the successful use of much less sensitive galvanometers. The acceptance of these latter instruments is based upon their ability to duplicate the original tracings of the Einthoven galvanometer. The genius of Einthoven, will long be remembered by cardiologists. Many years after the discovery of the galvanometer a friend wrote Einthoven, congratulating him upon the success of his instrument, but stating that while the instrument could write, it was a great pity that it could not also read. Einthoven replied that his galvanometer was not only able to write, but that it read secrets of the heart never before known.

For many years the electrocardiogram consisted of only three recordings, termed the three standard leads. The first lead is obtained by placing electrodes upon the patient's right arm and left arm. The second lead is obtained in the same manner but utilizing the right arm and left leg; and the third lead, from the left arm and left leg. In recent years additional leads have been extensively used. In most of these, one of the electrodes is placed at some definite point on the anterior surface of the chest and is termed the "exploring" electrode. The other electrode is placed remotely, on what might be called a neutral zone. For practical purposes, if only one precordial lead is to be used, it would be wise to select the fifth left interspace at the mid-clavicular line for

*Revised from two previous printings in this Journal. From the Cardiac Department of the Toronto Western Hospital.

the position of the "exploring" electrode, and to use the left leg for the location of the "neutral" electrode. As will be explained later, this is termed Lead CF4. The main purpose of using this and other precordial leads is that they frequently show more definite changes in obscure cases of myocardial infarction than do the standard leads. It is interesting to note that Waller in 1887 used a wide variety of leads, some of which are no longer considered of value.

When the electrocardiograph is operating, but before the patient is included in the circuit, the galvanometer string casts a shadow upon the moving film which leaves a heavy line termed the base-line, or more technically, the iso-electric line. With the patient attached, a series of deflections above and below the base-line appear, and these recur in an identical manner with each heart beat. There are five main deflections or waves, and these are arbitrarily designated as the P, Q, R, S, and T waves. To facilitate measuring the height or depth of these waves, the film bears horizontal markings one millimetre apart. Each fifth line is accentuated so that centimetres and half centimetres are clearly seen. The element of time is also recorded on the film, the latter moving at a rate of about one inch to the second. Vertical lines on the film record time intervals of 1/25 of one second, each fifth line being accentuated so that the time in fifths of a second is more easily recognizable.

An impulse from the sino-auricular node (pace-maker) initiates cardiac contraction. This impulse spreads in all directions through the auricular musculature, causing contraction and a coincident alteration in electrical potential recorded in the electrocardiogram as the P wave. The P wave therefore indicates contraction of the auricles, and it is missing from the tracing if the auricles do not contract as in auricular fibrillation. When the stimulus for contraction is picked up by the auriculo-ventricular node it passes, after slight delay, onward to the adjoining bundle of His, and thence through the two main branches of the bundle, and their terminal arborizations to quickly reach all parts of the musculature of the ventricles at approximately the same moment, so that a uniform and effective ventricular contraction may result. The passage through the ventricular portion of the bundle and its branches is coincident in the electrocardiogram with the Q, R, and S waves, the latter often being referred to as the QRS complex. Toward the end of this complex the ventricles commence contracting. After a short iso-electric period the T wave appears in the electrocardiogram, and the termination of this wave marks the end of the ventricular contraction. A period of rest ensues, during which the base-line is essentially level, until the next auricular systole occurs. One should now reread this paragraph, at the same time examining Figure 1, representing a normal electrocardiogram. It will be noted that the P, R and T waves are upright while the Q and S deflections (when present) are inverted. Frequently the T wave in the third lead is inverted, without being considered abnormal. The difficulty of distinguishing the three components of the QRS complex may be avoided, by saying that the main QRS deflection is upward or downward, as the case may be.

All the above mentioned points are significant, and the student should master them before proceeding with the study of abnormal electrocardiograms.

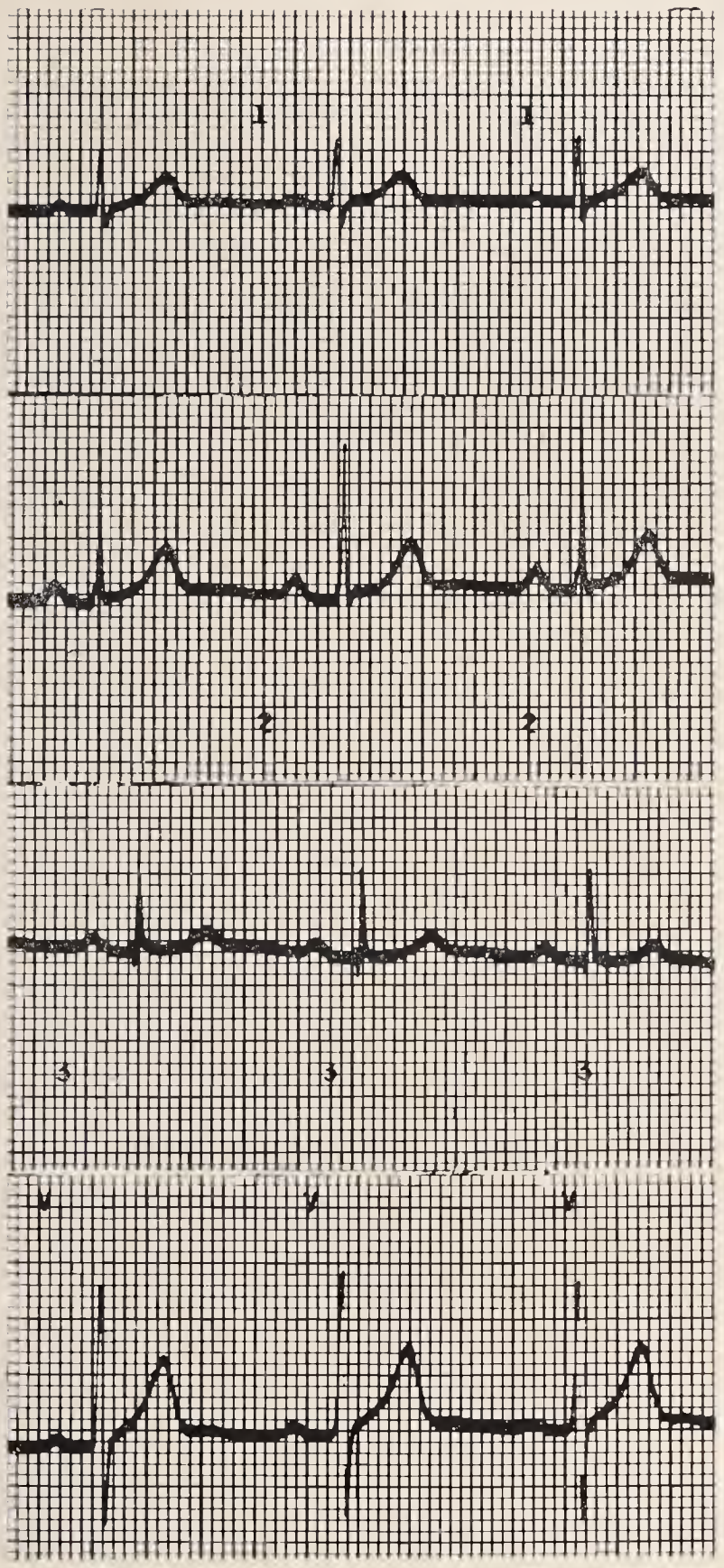

FIGURE 1. Normal electrocardiograms. Leads 1, 2, 3, and CF4.

In analyzing any electrocardiogram a definite routine should be followed. In this simple manner no abnormality will be overlooked.

The first procedure is to count the rate, for it is of great importance to know if it is within normal limits. The second consideration is to observe the regularity or lack of regularity of rhythm. These two points are mentioned first because they are so often overlooked by the student. After that, the P waves should be examined, and then the "P-R interval" which is the time from the commencement of the P wave to the commencement of the QRS complex. This should not be over one-fifth of a second. Next the QRS complexes should be examined, in respect to direction, height, and width. The total QRS complex should not last longer than one tenth of a second, and if it is longer in duration than twelve hundredths of one second a very definite abnormality is present. The R-T segment should now be examined to determine whether or not it deviates from the base-line. Finally the size and direction of the T waves should be noted. The time interval by which the T wave follows the QRS complex is not usually of much importance. Occasionally after the T wave, a U wave may appear; this is likewise unimportant.

For many years after the introduction of electrocardiography, its chief value lay in the study of cardiac arrhythmias. In recent years it has proved invaluable in the detection of myocardial disease, particularly so in the diagnosis of myocardial infarction. Instead of searching each tracing encountered, with a view to detecting certain premeditated abnormalities, analysis along the above mentioned lines is much more helpful; and on this account, the description of abnormalities which constitutes the remainder of this article, will follow the above general order.

1. *The Heart Rate*: This should ordinarily be between fifty and ninety. If below fifty, one must think of sinus bradycardia, partial heart block and complete heart block (see below). If above ninety, one must decide between

sinus tachycardia, paroxysmal tachycardia (either auricular or ventricular) auricular flutter and auricular fibrillation (see below).

2. *The Heart Rhythm*: The least important arrhythmia is sinus arrhythmia, an irregularity dependent upon the phase of respiration, or in any case being cyclic in type. Very common is arrhythmia due to extrasystoles (premature beats), either of auricular or ventricular origin. Irregularity may be due to partial heart block. In auricular flutter the heart beat is usually regular, but not always so. The most complete type of irregularity is that associated with auricular fibrillation. Other points in the electrocardiographic examination, mentioned below, will decide which type of irregularity is present. The question of heart disease is, of course, not dependent upon the finding of an irregularity.

3. *The P Wave*: This is usually upright in all leads. Inversion of the P wave in the third lead is not significant as a rule. If the P wave is inverted in leads 1 or 2, it means that an abnormal pacemaker has supplanted the S-A Node. If an occasional P wave occurs prematurely, it indicates an auricular extrasystole (Figure 2). Such P waves are frequently bizarre in their appearance, but they will be followed (usually) by a normal QRS complex. When a rapid series of successive premature P waves (each followed by a QRS complex) occurs, we have a paroxysm of auricular tachycardia. Such may persist from a few seconds to several days. Practically, auricular extrasystoles and paroxysmal auricular tachycardia are unimportant, unless other evidence of heart disease be demonstrated. Sometimes, in an otherwise normal tracing an entire heart beat will be missing, as shown by an absent P-QRS-T complex; this is termed sino-auricular block and indicates an omission on the part of the pacemaker, but is not usually important. Another point of interest is that in mitral stenosis the P wave in the second lead is frequently large in size and is often notched, (Figure 3). In two important abnormalities, P waves are entirely missing in the electrocardiogram. The first of these is auricular flutter. In this disorder the P waves are replaced by regularly recurring "flutter waves", at the rate of about 300 per minute. Rarely can the ventricle respond to these rapid impulses, so that the ventricular rate is frequently one-half or one-quarter of the auricular rate. Such a tracing is shown in Figure 4; and when once seen, an electrocardiogram of auricular flutter is unlikely to be confused

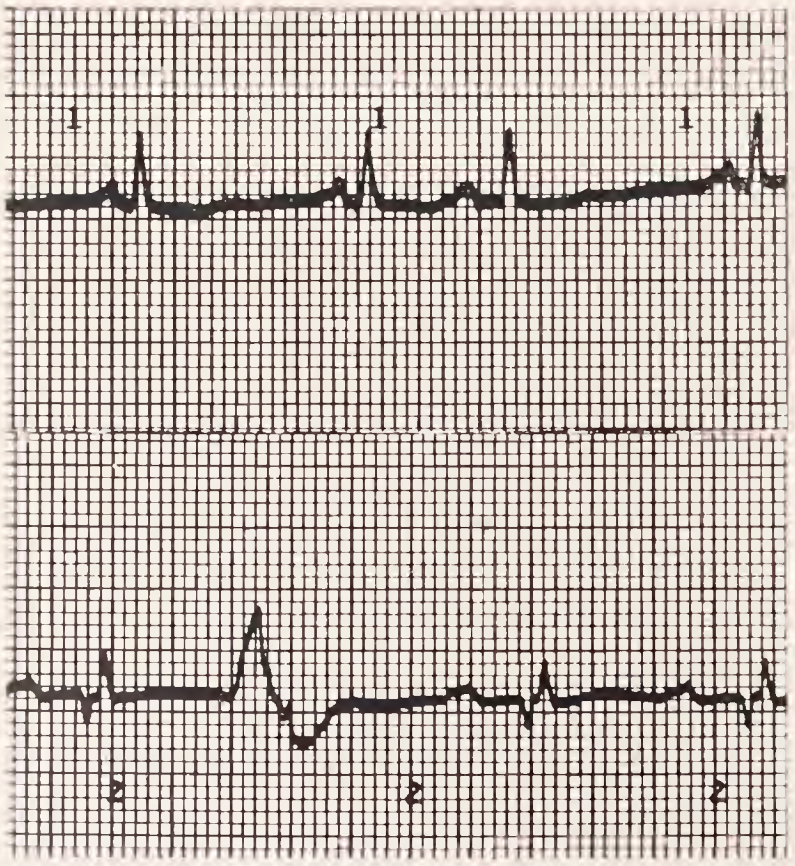

FIGURE 2. Lead 1, showing an auricular premature beat (extrasystole). Lead 2 (from another patient), showing a ventricular premature beat followed by a compensatory pause. The lower tracing also illustrates a prolonged PR interval, and widening of the QRS complexes, not related to the occurrence of ventricular extrasystoles.

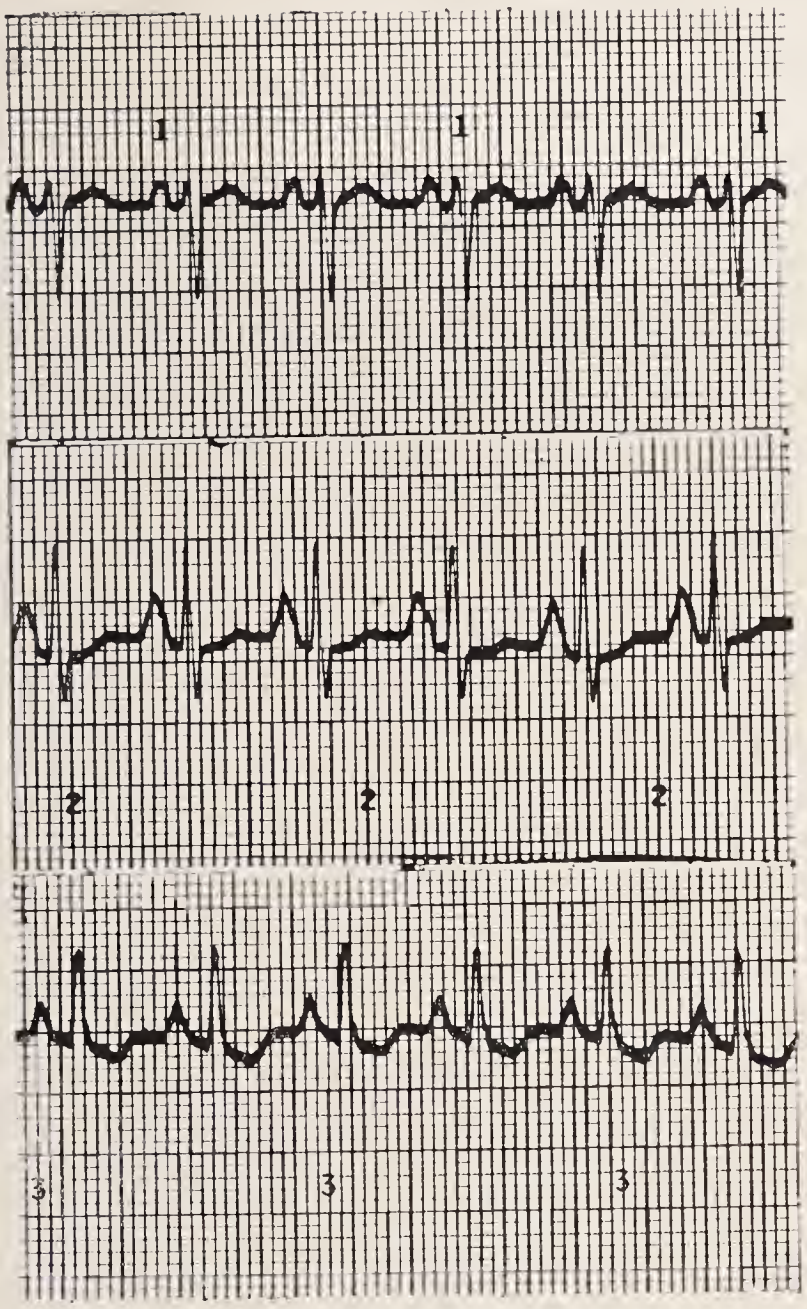

FIGURE 3. The three standard leads in a patient with mitral stenosis. Note the large P wave in lead 2, and right axis deviation. Sinus tachycardia is also present, the rate being 135.

with anything else. The auricular waves in flutter are usually large and of distinctive appearance in the second and third leads, but may be almost invisible in the first lead. The second abnormality in which P waves are entirely absent in the electrocardiogram is auricular fibrillation (Figure 5), a condition much more frequent and important than flutter. Here, the P waves are replaced by rapid small irregular variations in the base-line, which occur about 450 times per minute. Sometimes these small waves are invisible; usually they are seen in some portion of at least one of the leads. The ventricle responds poorly to these rapid irregular impulses, and in a completely irregular manner. The form of the ventricular complexes is not however unusual. The absence of P waves, the occasional appearance in the tracing of varying fibrillary waves, and the absolute irregularity of the timing of the ventricular complexes makes the diagnosis of auricular fibrillation certain.

4. *The P-R Interval*: As already stated the P-R interval should not be greater than one-fifth of a second. Where it is prolonged beyond this time, it indi-

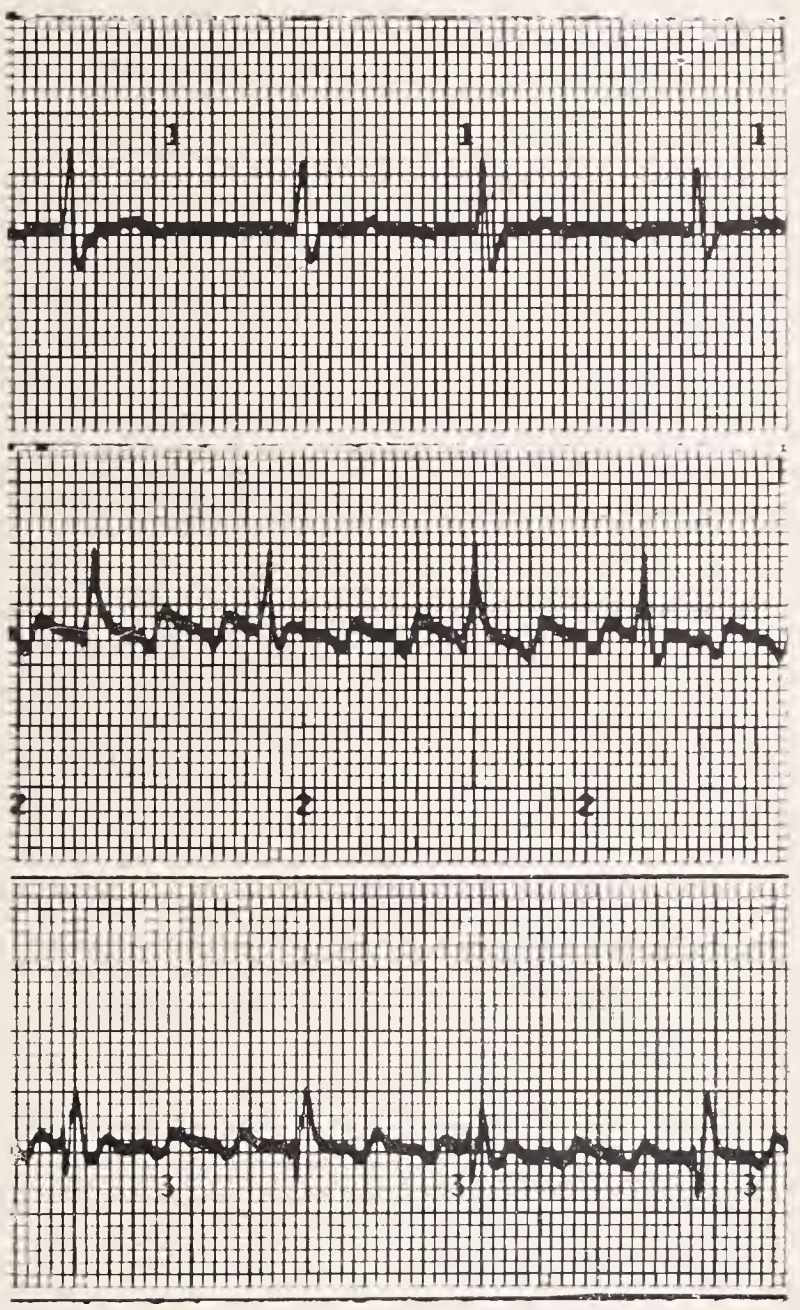

FIGURE 3. The three standard leads from a case with auricular flutter. Flutter waves are clearly seen in the leads 2 and 3, at a rate of 270. In this particular example, the ventricular response is irregular. There are two ventricular complexes for each six flutter waves.

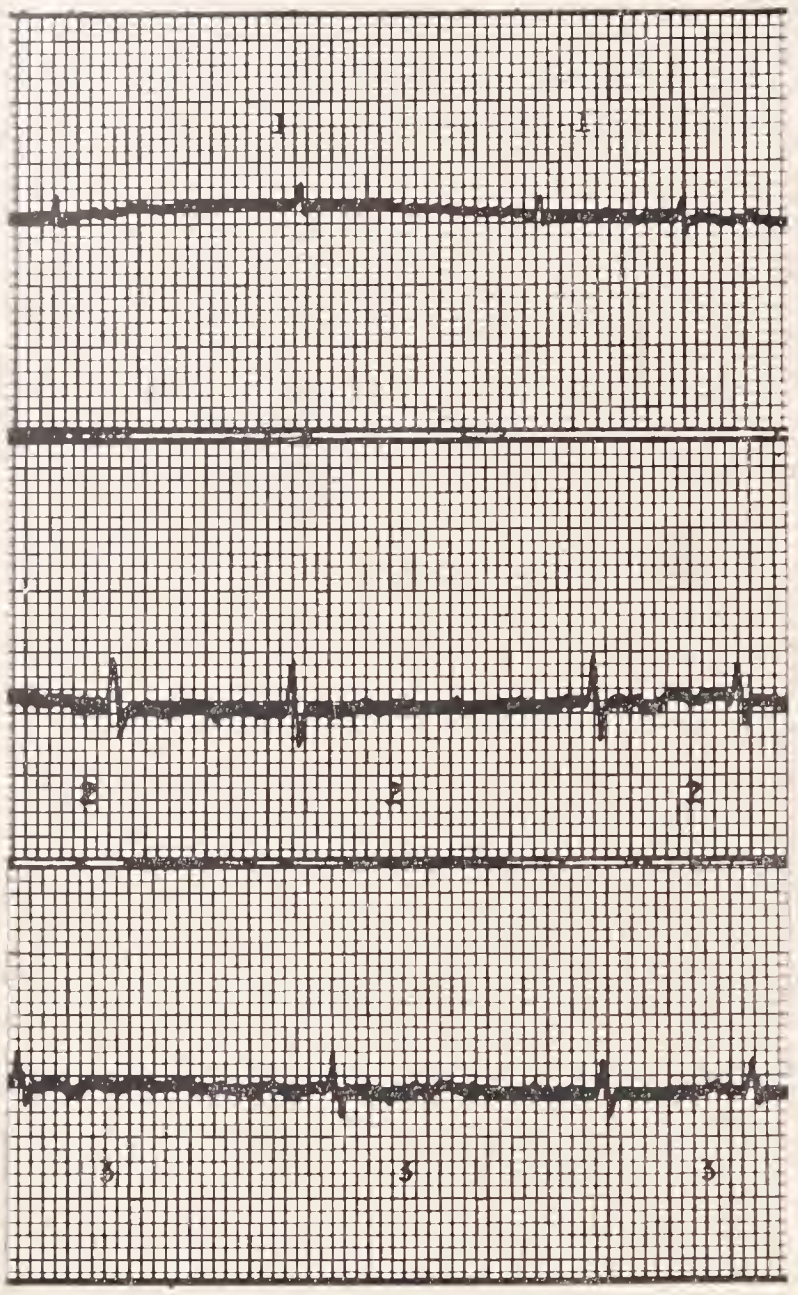

FIGURE 5. The three leads in auricular fibrillation. Note absence of P waves, rapid irregular fibrillary waves disturbing the base-line, and complete irregularity of ventricular responses. This tracing also illustrates "low voltage", and in lead 1 there is some 25 cycle alternating current interference.

followed by a ventricular response at all. cates a delay in the passage of the impulse from auricles to ventricles. This condition of delayed conduction is considered to be the first stage of partial heart block (Figure 6). In it each auricular beat is followed by a ventricular response, but the latter is abnormally, but uniformly late, in appearing. In the second stage of partial heart block, successive P-R intervals tend to increase in length until a point is reached at which a particular auricular contraction is not

A missed beat results, and in the electrocardiogram an isolated P wave is found. The third stage of partial heart block is where such missed beats are a regular occurrence. For instance, for each three P waves, only two QRS-T complexes might appear. This would be termed 3:2 partial heart block. Similarly 2:1 partial heart block would be diagnosed if a ventricular response was recorded only after each second auricular beat. At times complete dissociation between

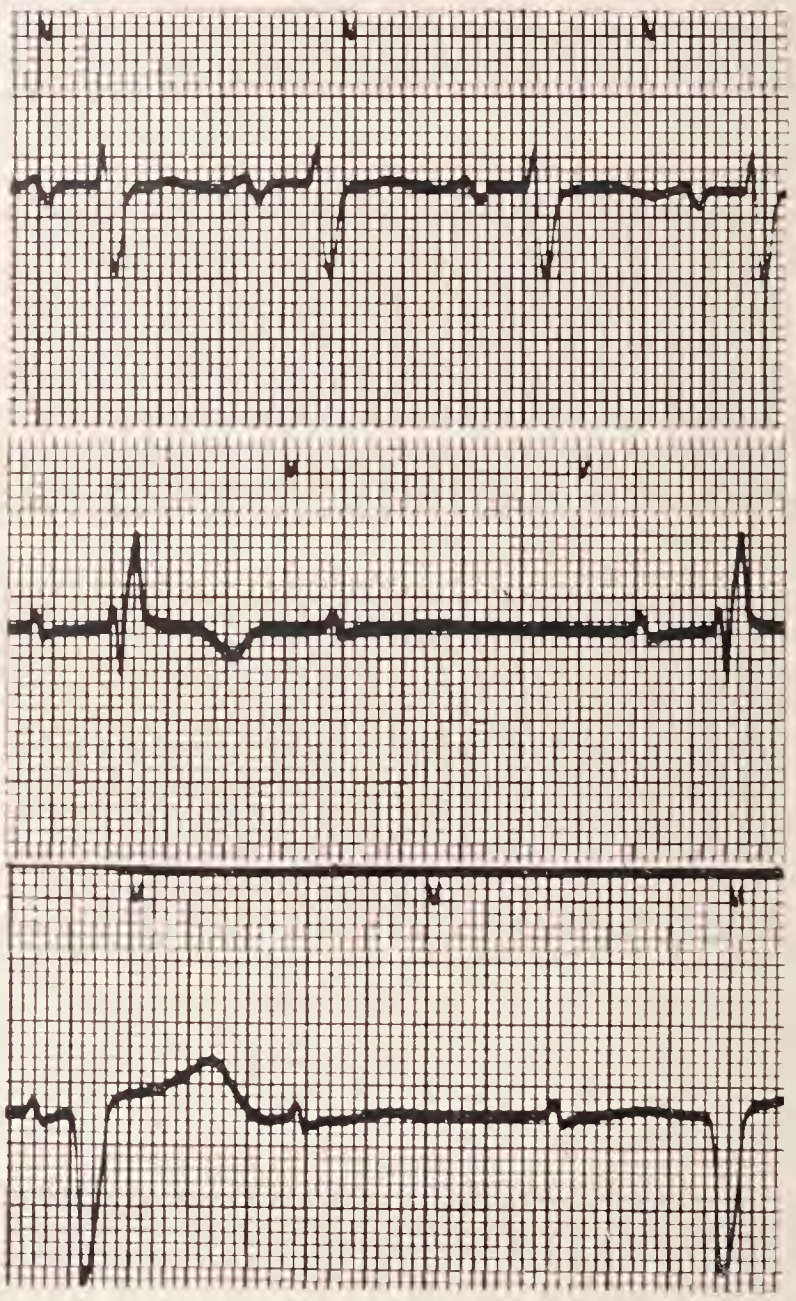

FIGURE 6. Single leads from three cases of heart block. The first shows a slight delay in conduction (PR interval about 0.26 seconds). The second shows 2:1 partial A-V heart block (auricular rate 58, ventricular rate 29), some PR prolongation also being present. The third shows complete heart block (auricular rate 70, ventricular rate 28). In the above tracings the QRS complexes are also abnormal.

auricles and ventricles occurs. This is termed complete heart block. Fortunately the ventricle takes on a rhythmic beat of its own, usually at a rate of about 30 per minute. Such an electrocardiogram commonly shows a regular succession of P waves at a rate of say 70, with regular QRS-T complexes at a rate of say 30, with no demonstrable relationship between auricular and ventricular complexes. Partial and complete auriculo-ventricular heart block usually indicate a deficiency in coronary arterial blood flow to the conducting system. They may also occur following the excessive use of digitalis. Delayed conduction may also be a valuable sign of active rheumatic myocarditis.

5. *The QRS Complex*: In the normal electrocardiogram, the main deflection of the QRS complex is upright in the three standard leads. In many tracings this is true of the first lead, but in the third lead the main deflection is downwards. This is termed left axis deviation (Figure 5), and is frequently found when the left ventricle is enlarged due to hypertension or aortic valvular disease, and also in normal hearts lying relatively horizontally, in patients with abdominal obesity and a high position of the diaphragm. Less frequently we find tracings with the main portion of the QRS complex directed downwards in the first lead, and upwards in the third lead. This is termed right axis deviation (Figure 3). This occurs when there is relative hypertrophy of the right ventricle, as in mitral stenosis and some types of congenital heart disease; and also in normal hearts, where the heart's position is low and central, in individuals with deep chests. In occasional tracings it is found that the maximum deflection of the QRS complex from the base-line in any lead, is less than five millimetres. This condition is termed low voltage, and may indicate myocardial damage, though not necessarily so. A fairly common and very important QRS disturbance is that known as Bundle Branch Block (Figure 7), inferring block in one of the main

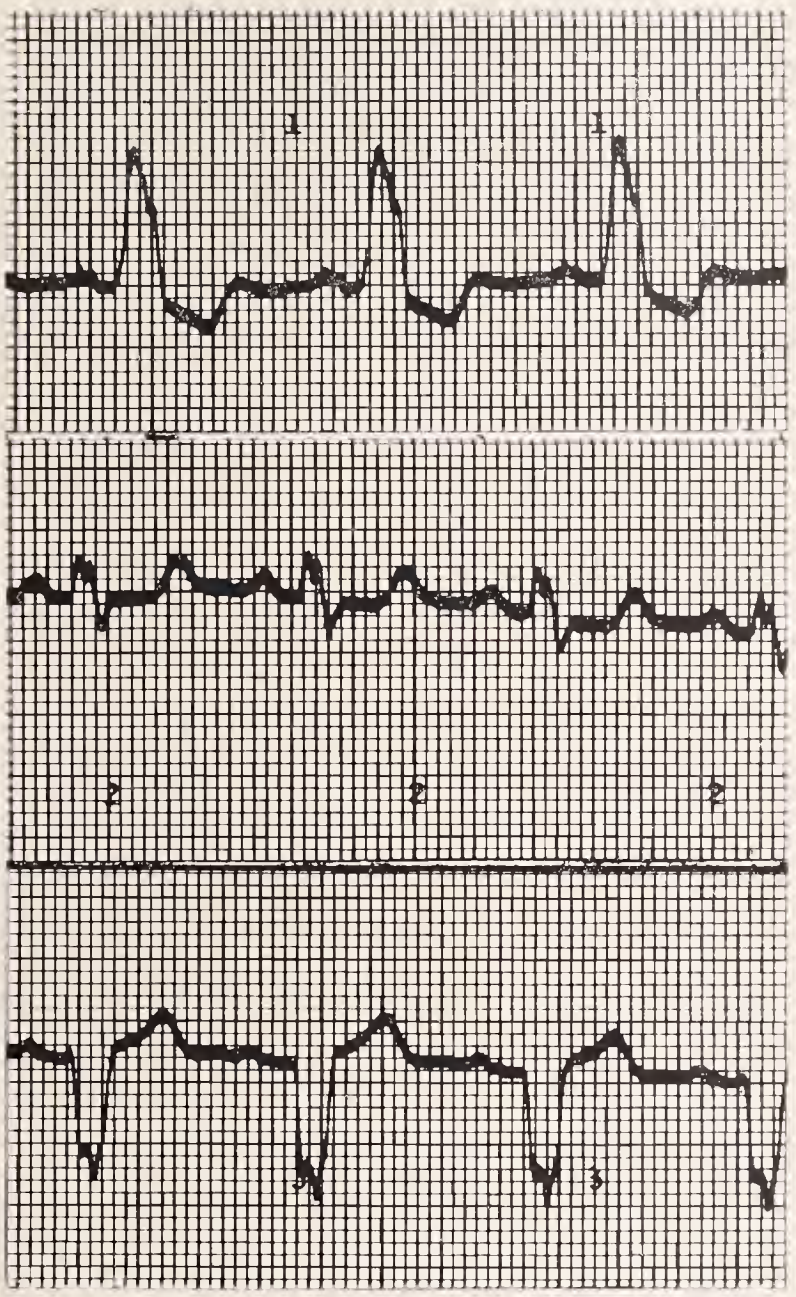

FIGURE 7. Left Bundle Branch Block. Normal P Waves (rate 80), followed by wide, notched QRS complexes with bizarre segments and T waves.

branches of the Bundle of His. In this abnormality the QRS complexes are all widened to twelve hundredths of a second or more, and notching and slurring of the complexes are present. In addition, the direction of the QRS complexes in leads 1 and 3 is opposite, and the T waves in these leads are usually opposite to the

main QRS deflections. Such tracings are mainly found in older people with myocardial degeneration resulting from disease of the coronary arteries. Of equal significance are other types of intraventricular block; in all of these tracings the essential feature is a widening of the QRS complexes of the degree above indicated. Mention should next be made of the relatively unimportant ventricular extrasystole (Figure 2). These are easy to recognize in the electrocardiogram, since they consist of premature bizarre ventricular complexes. The individual QRS-T looks much like the complex described under Bundle Branch Block, but it is always premature and not preceded by a P wave. Rarely one sees a tracing in which a series of ventricular extrasystoles occur in rapid succession (about 180 per minute), and this constitutes a paroxysm of ventricular tachycardia. The latter is usually of serious significance, because of frequent association with very recent myocardial infarction, but often responds to prompt treatment by quinidine or pronestyl.

6. *The R-T Segment and T wave*: These are discussed together because of the significant changes occurring in them after coronary thrombosis. These changes are due to alteration in the heart muscle, and not to the thrombosis itself. In a typical case, a few hours after the attack, one finds in the first lead either elevation or depression of the R-T segment (sometimes called the S-T segment) of the base-line, and referred to as a high or low take-off from the QRS complex (Figure 8). In the third lead the take-off will be in the opposite direction to that found in the first lead. (Changes in lead 2 tend to follow those in lead 3.) Usually the T wave is included in this strikingly altered portion

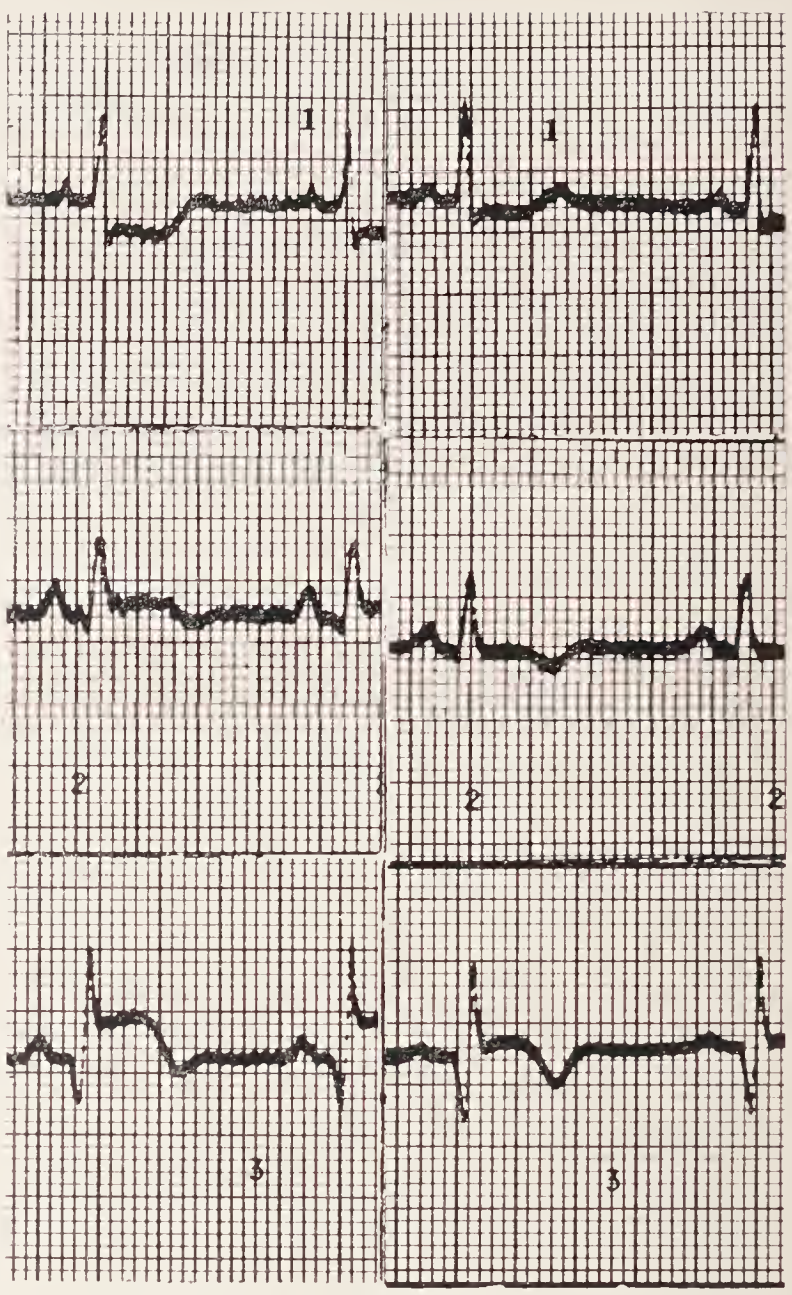

FIGURE 8. The electrocardiograms following posterior myocardial infarction.

Leads 1, 2, and 3 on the left were taken 24 hours after the attack. Note the low take-off of the ST segment in lead 1, and the high take-off in lead 3. Leads 1, 2, and 3 on the right were from the same patient three days later. The RT segments are returning to the base-line, and T waves are developing opposite in direction to the original RT segment deviation. Note also the prominent Q wave in lead 3.

of the tracing. In a very few days the raised or lowered RT segment again approaches the base-line and a T wave appears, opposite in direction to the original RT take-off. Over a period of weeks this T wave becomes either sharply inverted, or sharply upright as the case may be. It may persist as such, or the tracing may eventually return to normal. These changes, first described by Pardee,

prove the presence of myocardial infarction. In many cases of myocardial infarction, less spectacular changes are found; sometimes the electrocardiogram shows no significant changes whatever. In patients who are old enough to have coronary disease, the finding of flattened T waves in lead 1 or 2, or both, makes one suspicious of myocardial damage. Likewise the chance finding of deeply inverted T waves in the first or third leads (especially the former) arouses suspicion regarding previous myocardial infarction. One should bear in mind that digitalis administration frequently affects the R-T segment of the electrocardiogram, causing a spoon-shaped depression in one or more leads (Figure 9). This must not be confused with changes due to infarction. Moreover, after many years of hypertension, and after left axis deviation has developed in the electrocardiogram, the T wave in the first lead may become inverted, or even deeply inverted, without inferring previous infarction of the myocardium. Under these circumstances, there is usually some depression of the S-T segment in lead 1, but this continues as a persistent finding, differing from the transient depression which is part of Pardee's Sign.

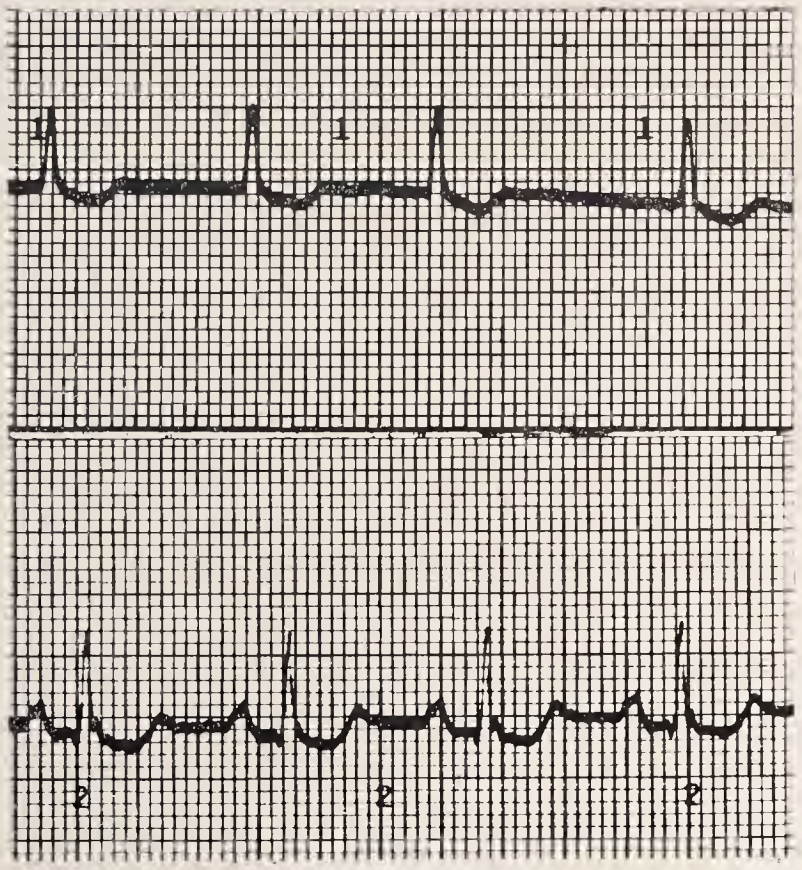

FIGURE 9. Digitalis effect. A spoon-shaped depression of the RT segments. The first example is in a patient with auricular fibrillation; the second, in a case with normal rhythm. This abnormality does not infer an over-dose of digitalis.

When the serial electrocardiographic changes resulting from myocardial infarction follow the pattern of elevation of the R-T segment in the first lead, with subsequent deep inversion of the T wave in that lead, there is customarily a corresponding disappearance of the R wave in lead 4, accompanied by R-T elevation and finally deep inversion of T4. These changes are termed "anterior" and are indicative of infarction in the region of the cardiac apex. When, on the other hand, the initial R-T elevation occurs in the third lead (with subsequent T3 inversion), one speaks of "posterior" infarction, expecting that the myocardial damage will lie in the posterior surface of the heart. In the latter case, there may be temporary depression of the S-T segment in the fourth lead, but changes in this lead are not as helpful for diagnostic purposes, as they are in "anterior" myocardial infarction. As a further diagnostic aid, "posterior" infarction is usually accompanied by the development of a prominent Q wave in lead 3.

Chest Leads: In the third paragraph of this article, reference was made to lead CF4. Normally, in this lead, the QRS complex consists of an upward deflection or R wave, followed by a deep S wave, and the T wave is upright. To obtain such a record on an electrocardiograph with a lead selector limited to the three standard leads, the selector is set at position 3, the left leg electrode is placed precordially, and the left arm

electrode is attached to the left leg. More modern electrocardiographs accomplish this same result without interchanging electrodes.

It is difficult in these modern days to define a standard electrocardiogram, although this was a simple matter prior to the introduction of precordial leads. Many insurance companies are still satisfied, in most instances, with a four lead electrocardiogram consisting of the three standard leads and lead CF4, as above described. In 1938, committees of the American Heart Association and the Cardiac Society of Great Britain and Ireland, announced their joint recommendations regarding the standardization of precordial leads. Six points on the chest were selected for the exploring electrode, and these were numbered from 1 to 6 as follows: (1) The fourth intercostal space just to the right of the sternum. (2) The fourth intercostal space just to the left of the sternum. (3) A point midway between the last position and the next one to be mentioned. (4) The fifth intercostal space in the mid-clavicular line. (5) A point at the same horizontal level in the anterior axillary line. (6) A point at the same horizontal level in the mid-axillary line. When these six exploratory points taken in turn, are paired with a "neutral" electrode placed on the left leg, the leads are termed respectively, CF1, CF2, CF3, CF4, CF5, CF6.

Later, it was decided by Wilson of Ann Arbor, that the left leg was not a suitable point of "negligible potential". He, therefore, devised a central terminal which was connected to each of the three extremities (right arm, left arm, and left leg), a 5000 ohm resistance being inserted in each of these three connections. When the six exploring points in the precordial area are paired respectively with this central terminal, the leads are designated V1, V2, V3, V4, V5, V6. Actually, these several leads are very similar to the CF leads above mentioned. In most instances, the V leads have now superseded the CF leads.

In Toronto, the hospitals frequently record a six lead electrocardiogram, which might be considered "standard". This consists of the three standard leads, and three chest leads, usually V1, V3 and V5. If a more complete electrocardiogram is required, it usually consists of twelve leads as follows: the three standard leads, the six precordial leads from V1 to V6, and three augmented limb leads recorded by a method described in any standard text. A discussion of these more complicated leads, and of rarer electrocardiographic abnormalities such as nodal rhythm, ventricular escape, etc., is beyond the scope of this present paper. More than enough has already been said for the average medical student, and my wish is to stimulate interest and thought, rather than to exhaust the details of the subject.

Electrocardiography has a definite place in the study of heart disease. It will never serve to replace a careful clinical examination. In an occasional tracing, a clinical diagnosis is suggested. Such may be the case in tracings following coronary thrombosis. Also, mitral stenosis is most probably present when right axis deviation and auricular fibrillation jointly appear in the electrocardiogram, because of the frequency with which each is met in mitral stenosis. Ordinarily, however, the electrocardiogram must be viewed merely as an adjunct to the cardiac examination. Any opinion based on the electrocardiogram alone is not only unwise but uncertain.

PLASMA VOLUME EXPANDERS IN BURN SHOCK

JAMES B. BASSINGTHWAIGHTE, B.A., 5T5

Introduction

Since the first Great War restoration of the circulating blood volume has been recognized as the single most effective measure in the treatment of severe injury. Although blood is the most satisfactory replacement solution in shock following hemorrhage (or plasma plus blood in severe burn shock) certain problems are encountered. Transfusion, now a relatively safe routine hospital procedure, involves time-consuming preparation. Furthermore, blood cannot be procured in great quantities and storage longer than 3 or 4 weeks is not feasible. In civil or military emergency it would be quite impossible to insure an adequate supply of blood for shock therapy. The storage of serum and plasma, which are very good replacement solutions in burn shock, is possible over long periods but the same difficulties of high cost and procurement in quantity exist.

These considerations have intensified interest in other substances that can be used to expand the blood volume, yet be stockpiled in large quantities and stored indefinitely. The terms "blood substitute" or "plasma substitute" applied to such substances are misnomers, objectionable from the theoretical and the practical point of view. They are deficient in several important functions, such as furnishing essential nutriments, buffering action, transport and mobilization of antibodies, and protection against blood loss by components of the clotting mechanism. Narat (6) proposes that the terms be abolished from medical literature and the lay press, for they may create among prospective donors the misconception that whole blood is no longer necessary. While he prefers the terms "blood volume replenisher" or "blood volume expander" it is felt that "plasma extender" or "plasma volume expander" are more appropriate since they indicate that the restoration and stabilization of blood volume occurs in the fluid portion of the blood. These will be referred to henceforth merely as expanders.

History

The first expanders, developed by Bayliss in 1919, were fluids containing colloid having an osmotic pressure similar to that of plasma proteins, and could be used to maintain the circulating volume in shock. His first success was with gum arabic or acacia, after finding starch and dextrin unsatisfactory. Acacia, in 6% solution in physiological saline, was used clinically and gave remarkably satisfactory results. In severe hemorrhages the "gum saline" infusion increased venous return and cardiac output thereby allowing the full utilization of the available hemoglobin. Its retention in the circulation for long periods maintains the circulation until the patient can resynthesize his plasma proteins. Gum arabic, pectin, polyvinyl alcohol, and methylcellulose are no longer used, for they were found to become stored in many organs, particularly the liver,

causing interference with function. During the last war polyvinylpyrrolidone was used extensively in Germany and dextran in Sweden. In the past few years these and other similar products have appeared on the market here. They are all macromolecular colloids with a wide range of molecular size.

Physiological Considerations

It is well known that there is a wide margin of safety in the oxygen-carrying capacity of the blood; that is, the primary objective in shock treatment is restoration of the circulating volume rather than of hemoglobin.

The impermeability of the capillary membrane to plasma proteins and the protein function of retention of fluid in the circulation by osmotic force were recognized by Starling in 1896. The glomeruli of the kidney are similar to capillary filters elsewhere in the body, and are freely permeable to substances with molecular weights (MW) of less than 10,000 and completely impermeable to those with weights greater than 70,000.

Immediately after an infusion most of the expander can be accounted for in the blood. But several avenues of escape are present and renal filtration is the chief pathway for removal from the body. Evidence for tubular reabsorption or excretion is lacking, while renal clearance experiments support the case for simple filtration. The low MW fractions (less than 10,000) are cleared at the same rate as creatine, which is the indicator of glomerular filtration rate. The rate of excretion of the heavier fractions is inversely proportional to the MW. Thus one would expect the smaller particles of a mixture to be rapidly excreted, so that in time the rate of excretion diminishes and the mean MW of the retained fraction increases, all of which has been demonstrated experimentally for dextran, gelatin, OPG, and PVP.

The expander escapes also into the interstitial fluid and lymph, but theoretically the largest molecules would circulate until picked up by scavenger reticulo-endothelial cells and either metabolized or stored. Storage has been demonstrated with several expanders, especially those of high MW, and may be important if it is associated with any functional disturbance.

The mechanism by which plasma expansion is achieved and maintained after the infusion of expanders is not entirely clear at present. Recent work by Hyde (4) indicates that it is mainly an osmotic pressure effect. They showed that the volume expansion produced within an hour after the infusion was greater for dextran, gelatin, and concentrated serum albumin than for plasma and was greater than the volume infused. These solutions were hypertonic and the expansion was related to the osmotic pressure. Hemodilution following infusion is a constant finding, and is reflected in a decrease of hematocrit and total protein concentration. Experimental observation suggests that the macromolecular substances start a cycle of "autotransfusion", that is, they may be replaced by labile protein stores as they leave the blood stream. The fall of the blood colloid level is mirrored by a rise in plasma protein (1, 9), and hemodilution is still seen when the colloid concentration has fallen to insignificant levels (3). Considering this, we see that volume maintenance is a function of protein replacement (as in the uninfused patient) as well as colloid retention. In burns relief of hemoconcentration is an

object of early treatment and expanders are even more useful here than in ordinary shock where there is no hemoconcentration.

Plasma Volume Expanders

Classification: Expanders may be classified, according to origin, into four groups: (1) those of animal origin, such as human serum, hemoglobin, albumin, globin, bovine serum, ascitic fluid, casein digests, isinglass, gelatin, and oxypolygelatin (OPG); (2) those of vegetable origin, such as gum acacia, pectin, methylcellulose, and a polysaccharide from okra; (3) synthetic products, such as polyvinylalcohol and polyvinylpyrrolidone (PVP) and (4) biochemical products, such as dextran, amino acid polymers, and polyglucose.

Few of these approach the ideal—a substance as effective in every respect as plasma. Expanders have the advantage over plasma in not involving any risk of infection with hepatitis, malaria, or syphilis. Another point worthy of consideration is the cost: plasma costs about $35 per pint while the expanders range up to about $6 per pint. Large volumes are required even in routine hospital treatments and so the saving can be tremendous.

Theoretical requirements. Positive requirements are (1) that the colloid be of an optimum molecular weight, that is, high enough that it is not rapidly excreted but is retained in the circulation for several days, and not so high that renal excretion is impossible; (2) that the osmotic pressure be equal or slightly greater than that of plasma protein, and the viscosity be comparable; (3) that production is possible in quantity at low cost and the composition of different lots be the same; (4) that storage for long periods at varying temperatures has no ill effect; and (5) that it is capable of sterilization.

Negative requirements are that (1) it is not toxic; (2) it is not pyrogenic; (3) the patient does not become sensitized to it; (4) it does not become stored in the tissues but is either metabolized or excreted completely; and (5) it has do diuretic action.

Properties of certain expanders. A very extensive review of the whole group of plasma extenders has been made by Gropper, Raisz, and Amspacher (3). Only a few of the expanders are worthy of consideration here. Some, like fluid gelatin, polyglucose, amino acid polymers, and casein digests are too new to be evaluated as yet. Animal blood products are antigenic, otherwise they would be very suitable. Human globin, readily available from outdated banked blood may be a useful expander. The most important expanders are at present dextran, PVP and OPG.

Electrolyte replacement is of great importance in shock therapy, so all the expanders are made up in 0.9% saline. Saline is also given alone, in spite of the fact that its retention in the circulation is very brief. It restores extracellular fluid and electrolyte and makes up for loss of electrolyte into the burned area, through the kidneys, and in the sweat.

A. Dextran. At present dextran is the most popular expander. Known also as Macrodex and Intradex, it is a polysaccharide produced from sucrose by the growth in culture of various microorganisms. Recently enzymic polymerization has been accomplished using a sucrase from Leuconostoc mesenteroides in a cell free medium. The long polysaccharide molecules produced are too large for infusion but after partial hydrolysis

to a mean MW of 70,000 or less the solutions are quite satisfactory. There is no agreement as to the ideal MW and the products used now vary from an average MW of 34,000 (Swedish) to 73,000 (British) with the range about 10,000-100,000 in any given product. Probably the ideal is a narrow range MW product—between 50- and 60,000. It is evident that if the dextran is of such low MW that it will pass the glomerular filter it is of little use in maintaining the circulating volume. On the other hand very high MW dextran will cause renal damage. No toxic effects have been observed from the dextran extensively used over the past several years, although Swedish dextran, but not American (average MW of 41,000), has shown a fairly high rate of allergic reactions (3).

Dextran has an advantage over other plasma extenders such as PVP in that it can be hydrolysed into glucose by acids, suggesting that it may be metabolized slowly, although the 1-6 linkage which predominates, appears to resist enzymic hydrolysis. The 6% dextran is supplied in 0.9% saline has an O.P. (osmotic pressure) of 1.3 to 2.0 times that of plasma. It is well retained in the circulation and maintains the O.P. until replaced by plasma proteins. It is not pyrogenic and the only consistent reaction is an increase in erythrocyte sedimentation rate (ESR) with rouleaux formation and interference with hemagglutination tests unless diluted. Dilution of the patient's serum with two or three volumes of saline lowers the dextran level so that it will not cause rouleaux formation of the prospective donor's cells, but cannot be recommended as routine since very weak agglutination and blocking antibodies would be more readily overlooked. It is best to obtain a sample of serum before infusing dextran so that if a later transfusion is required, serum free from dextran is available for a direct matching test.

The fate of dextran in the body is still a matter of some conjecture, and is of great importance, for the ideal expander must be completely metabolized or excreted. Evidence suggests complete disappearance from the body gradually, but a small portion has been detected in the spleen and lymph nodes of rabbits after eight weeks. Excretion is of low MW polysaccharide, probably after slight degradation in the tissues. Studies using C^{14} labelled dextran indicate that a small amount is metabolized, probably as glucose. No histological abnormalities can be attributed to the newer dextrans; with older preparations foam cells could be demonstrated transiently in kidney, liver and lymph nodes—likely an effect of higher MW particles. Furthermore no kidney function change can be shown, other than an occasional and temporary reduction in TmPAH.

B. Oxypolygelatin. Gelatin was tried early in the search for plasma extenders since it is non-antigenic and easily digested. However its tendency to gel (a viscosity effect) at infusion temperatures was a major drawback. Pauling and Campbell in California developed a method for reducing the viscosity without decreasing the molecular size. The average MW is 30,000 and the range about 10,000 to 100,000 in a recent preparation. Condensation of a decalcified gelatin with glyoxal, followed by oxidation with hydrogen peroxide produced a stable "oxypolygelatin" (OPG) which could be autoclaved and gels reversibly at temperatures less than 18°C. A standard OPG can be manufactured cheaply and in large amounts.

OPG has a greater osmotic activity than gelatin, and in the usual 5% solution has a slightly higher O.P. than plasma. Retention in the circulation is short compared to dextran and PVP, less than 50% remaining after 6 hours and none in 48 hours. Digestion in vitro by trypsin and pepsin indicates ease in complete removal from the body; storage of the larger particles is not nearly as likely as with PVP.

Clinically OPG is well tolerated; good results have followed use in traumatic and burn shock. Although it would be much improved by doubling the average MW and narrowing the range of molecular sizes, it is even now a most satisfactory adjunct to the list of expanders.

C. Polyvinylpyrrolidone. PVP, first manufactured in 1940 by the Bayer Company in Germany was used extensively during the war. It is known variously as Periston, Kollidon, and Subtosan.

The amorphous white powder is a polymer of acetylene and formaldehyde, containing acidic radicals and forming clear solutions. It can be stored indefinitely, is heat stable, allowing sterilization, non-antigenic, non-pyrogenic and, so far as is known, non-toxic. The solutions on the market are 3.5% in physiological saline and have a colloidal O.P. of 30-33 mm. mercury.

The polymer exhibits a wide range of molecular weights (from 5,000 to 80,000) the average in two American preparations being 33,000 and 56,000). As a result much of the colloid is soon excreted in the urine and lost to extracellular fluid, this lower MW fraction being quite ineffectual as a volume expander. While early workers estimated that an effective concentration remained after 2 to 3 days, and only 50 to 75% was accounted for in the urine after 5 days, more recent work (3) indicates that excretion is much more rapid, about 50% appearing in the urine in 2-6 hours. PVP also appears in mothers' milk and fetal blood, and over 10% may be eleminated through the bowel.

Like the other expanders PVP causes an aggregation of erythrocytes and a temporarily increased E.S.R. It has been used in retarding the absorption of penicillin, insulin, and various other drugs, for it has marked adsorptive properties. To it Heilmeyer has attributed some ability to assume the transport function of plasma proteins, and Schubert refers to its "vehicle function"—the power to chemically bind dyes and bilirubin and thereby effect their renal excretion when a malfunctioning liver cannot.

The fate of the larger molecules is a major question. Storage probably occurs in the reticulo-endothelial system, and radioactive carbon studies show the presence of very significant amounts. To some investigators storage is a contraindication to use, although no permanent pathological cellular changes have been detected. There is no evidence that PVP can be metabolized; storage is roughly proportional to the molecular size.

Pathological Considerations

Plasma volume expanders are most important in the treatment of burns. The fluid treatment, which is only one phase of burn therapy, is necessary to keep the circulatory system functioning wtihin physiological limits. An idea of the local pathology of burns helps to explain the systemic effects; why expanders are so effective is explained by the nature of the systemic injury.

Local. The degree of hyperthermic injury varies with the intensity and duration of the exposure. A low intensity (45°C.) can produce irreversible change after a few hours. A high intensity flash burn may remain quite shallow; scalds and flame burns may produce full thickness necrosis over nearly the whole extent (5). Any given burn will include a wide range of thermal effects, and differentiation of the areas of second and third degree burning is important in deciding treatment.

First degree burns exhibit merely hyperemia, and some edema, and need not be considered here for no treatment is necessary. Second degree burns destroy the epithelium but little of the dermis and are extensively blistered and painful. Third degree or full thickness burns are charred or coagulated; they may be black, or white and cadaveric, or deep pink and transparent showing a network of thrombosed vessels which do not blanch on pressure. Blisters broken or unbroken may also be present as in second degree burns. Deep second degree burns are difficult to distinguish from third degree, for the latter, though usually anaesthetic, may retain sensation for several days. Blanching on pressure and quick return of redness on release is indicative of intact circulation and second degree injury, but thrombosis of the superficial vessels may hide this sign.

The extent of the burnt area, often overestimated, should be determined fairly accurately by outlining the area on a chart of the body (2). Direct determination by the "rule of nines" is convenient; head and neck—9%, each arm—9%, front of trunk—18%, back —18%, and each leg—18%.

Systemic. Secondary burn shock is diagnosed by the presence of anxiety and confusion, sweating, a rapid pulse, clammy slate gray extremities with a a slow return of colour after blanching by digital pressure, and cessation of renal output. Blood pressure does not always fall; anuria is the most significant sign. This shock is mainly a result of hemoconcentration due to fluid loss into the burned area. The increased permeability of the capillaries beneath the zone of coagulative necrosis allows loss of high protein (about 4%) edema fluid. There is increased lymph flow from the area but during the first 48 hours formation exceeds return and the burn may weep copiously. Healing of these hyperemic capillaries balances the fluid flow in the area and now the absorption of toxic products becomes important. The great absorptive power of the burn is seen by the rapid intake of toxic amounts of sulphonamides applied to the surface. Systemic injury may result from the release of proteolytic enzymes by the damaged cells or possibly even from heating of the blood at the time of the burn.

The hemoconcentration, low B.P. and systemic anoxia of secondary shock predispose not only to phlebothrombosis, but also to degenerative changes in the liver and kidneys. Oxygen therapy has proven very valuable in shock, not only in relation to VEM and VDM and in decreasing capillary permeability, but also in raising the blood pressure increasing the heart rate and overcoming hemoconcentration (7).

In severe burn shock the anoxia and intravascular hemolysis of erythrocytes is predisposing to the development of hemoglobinuric nephrosis. This is heralded by early hemoglobinuria, later by pigmented casts and acid urine. (Acidosis is usual in severe shock.)

Oliguria and development of high blood NPN indicate the beginning of renal functional failure which may lead to anuria and death by uremia. The role of burn toxins in this syndrome is not known; it is probable that the vasomotor mechanism of the medullary shunt and renal cortical ischemia of shock plus some tubular blockage with hemoglobin because of the low glomerular filtration pressure, are the important factors.

Fluid Treatment of Burn Shock

Restoration of the circulating volume and extracellular electrolyte is the most effective measure in the treatment of shock and anuria. This becomes exceedingly important in burns over 20%. The amount of colloid (plasma or expander) to be administered will vary with the extent of the burn and is equal to the estimated amount of plasma lost into the burn and from the burn surface. In addition electrolyte must be given for the normal requirements of kidney excretion, water to make up the insensible loss, and some nutrient solution to prevent starvation acidosis. For burns over 25% the plasma loss may be assumed with a fair degree of accuracy to be 10% of body weight in 48 hours. Calculations using the surface area formulae for smaller burns and the interstitial space expansion formula for larger ones do not differ greatly from this simple measure. These formulae are based on the theory that fluid loss is proportional to the extent of the injury, that edema formation decreases exponentially with time after injury.

This means that a 60 kilo man with a 30% burn should receive in 48 hours:

6000 cc.	expander for edema and exudate loss
3000 cc.	dextrose in saline for renal loss
3000 cc.	dextrose in water for lung loss.
Total 12000 cc.	

Of the expander, if the loss decreases exponentially, one-half should be given in the first twelve hours, one-quarter in the next twelve, and one quarter in the next twenty four. If the patient is obviously shocked when brought in, a third of the twenty-four hour volume of expander (1500 cc. in this case) should be given in the first hour.

As much as possible of the saline (or Ringer's solution) and the nutrient solution (usually 5% dextrose) should be given by mouth, as palatable fluids. In many cases oral administration will be difficult and fluid may have to be given intravenously for several days. Sodium bicarbonate is often very useful in the treatment or prevention of acidosis.

Although plasma and reconstituted serum are to be preferred, the expanders are just as effective in shock treatment. The above fluid treatment is strictly empirical of course,—renal output is used as an indicator of the efficacy. Patients with over 25% burns should have an indwelling catheter for the first five days so that hourly output can be measured. Excretion of 50-150 cc./hr. in adults indicates sufficient intake. A very low output (5-20 ccs.) indicates a need for increased therapy; and if the output doesn't increase, then development of hemoglobinuric nephrosis must be considered. This calls for immediate

restriction of salt intake, and only enough fluid is given to replace insensible loss through the skin and lungs. Plasma NPN determinations will indicate the seriousness of renal failure. Hourly outputs of more than 200 ccs./hr. in the first 48 hours means overtreatment; later it is caused by the spontaneous diuresis following the sodium retention occurring up until now. This is the signal for a drastic reduction in infusion rate to an intake calculated to replace insensible loss and no more. The patient loses the weight he has gained in sequestration of edema fluid under the burn and becomes less ill.

Hemoglobin estimations and blood counts will also be guides to continued intravenous therapy and should be done every few hours. Secondary anemia develops rapidly in severely burned patients and should be relieved by transfusion and daily doses of iron.

Comparison of Plasma Volume Expanders

Having considered the physiological characteristics of the expanders, and why they can be so valuable in replacement of the fluid loss in burns, the reader is in a position to appreciate the results of experimental and clinical studies. Experience with expanders in burn shock has not been as extensive as in traumatic shock but a lot of interesting work has been done. Although opinions on the relative merit of the expanders is variable, on one thing there is agreement—plasma volume expanders fulfil their purpose now and are being improved all the time.

Dextran is the preferred expander. In Sweden, Britain, and the U.S. it has been found to be satisfactory replacement, and shock control in patients with second and third degree burns has been managed on dextran alone. It is used routinely for burns at the Hospital for Sick Children.

Gelatin has been found to produce a response comparable to that of plasma in the prevention or early treatment of hemorrhagic shock, and is good in burns, except for the short duration of its effect compared with dextran.

PVP, in animal studies (8), does not appear as good as dextran, and its effectiveness relative to OPG is variable. Although not yet used extensively on this continent, clinical use after hemorrhage, burns and during surgical operations has given favourable results.

These are the three substances under consideration for stockpiling in case of emergency. They are all effective in restoring blood volume and pressure, and thus in maintaining circulation; the effects persist long enough for the body to recover from the insult which it has received, and to resume its function of plasma protein replacement. It is likely that all substances capable of expanding the circulating volume for a sufficient period possess the same potential usefulness and clinical limitations. The expanders that will eventually find a permanent place in the treatment of burn shock will probably be selected on the basis of relative toxicity, absence of storage phenomena and low cost of manufacture.

Summary and Conclusions

(1) Plasma volume expanders are very effective clinically, so much so that the administration of plasma appears to have no advantages.

(2) These macromolecular colloids are cheap, readily available, non-antigenic, can be sterilized and stored for years.

(3) The outstanding unsolved problem with expanders is that of obtaining a narrow optimal range of molecular weight.

(4) The treatment of burn shock requires a plasma volume expander, electrolyte, and occasionally whole blood.

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IT'S THE LAW

Can you recall the laws listed below?

1. Courvoisier's Law
2. Starling's Law
3. Weber-Fechner Law
4. Bowditch's Law
5. Koch's Laws
6. Haeckel's Law
7. Marey's Law
8. Mendel's Law
9. Allen's Paradoxic Law
10. Goodell's Law

(*See Answers on page 256*)

WILLIAM CUSHING HARVEY

THOMAS A. McCULLOCH, B.A., 5T5*

Every medical student at sometime in his career, usually by the time he has finished his preparatory study, has heard of William Harvey. Generally all this means to the student is that "he was the man who discovered the circulation of the blood". We have all heard of him and our knowledge of his discovery is furthered by the Physiology Department in the form of a film sometime during the laboratory periods of the First or Second Medical Years. It is not my intention to dwell upon this aspect of Harvey's life, interesting though it is, but rather, I hope to look into the personality and life of Harvey as well as the social, political and personality of the age in which he lived.

Harvey's Life.

William Cushing Harvey was born on the 1st of April 1578, one year after the man who became his greatest protagonist, Jean Riolan of Paris. The birth took place at Folkstone, Kent, the eldest of nine children, seven boys and two girls, to be born to Thomas and Joane Harvey. From this date until his graduation with the B.A. in 1597 not much appears to be known. He was educated at King's school Canterbury and here evidently became well drilled and well versed in the classics since in later life he often quoted Virgil his favorite poet in his scientific writings.

While at King's College Harvey showed a leaning toward natural history and possibly because of this he was nominated to a scholarship at Granville and Caius Cambridge in order to prepare himself for the study of Medicine. It is thought possible he watched dissections while at Cambridge since the school was allowed the bodies of two criminals annually for the purpose of dissection with a view to the increase of the knowledge of Medicine. In 1597 he graduated with his B.A.

From 1597 to 1600 nothing is mentioned of being of great interest in Harvey's life. He may have gone immediately to Padua to carry out further studies before entering medicine but no evidence is available of his having matriculated. It is also possible he lived at home with his parents during this period. As his father was a man of some means Harvey could very well have spent his time investigating the problems of Natural History that so intrigued him. However, in 1600 following the lead of many others before him he entered on his Medical course at Padua school of Medicine.

The University at Padua was founded in 1222 by Emperor Frederick IV although other accounts list its founding as 1260 and sanctioned in 1263 by Pope Urban IV. It produced a number of famous men among whom can be listed Fabricius and Vesalius. While here Harvey chose as his chief teacher Fabricius Ab Aquapendente. It was the custom at the school to choose ones own teachers as the University was a Student's University. The students also had

*From a paper delivered to the Osler Society, Feb. 26th, 1953.

the main direction of courses and the power to elect their own teachers. They were enrolled according to their nationalities and each nationality had the power of electing one representative who along with the Rectors formed the executive of the University. Harvey was chosen as the Concilarius or councilor of the English Nation. Harvey's tablet or stemmata can be found on the wall and roof of the cloister which is equivalent to our practice of having a graduation picture taken.

In 1593 an anatomical theatre had been erected by the Seignory of Venice as a tribute to Fabricius and it was here that Harvey studied. The theatre was made up of high circular galleries that rose in tiers almost to the roof. Here the dissections were carried out by candlelight—under the direction of Fabricius with the subjects being brought up through a trap door in the floor.

While at Padua, Harvey and his teacher Fabricius became warm friends and Harvey was particularly stimulated by Fabricius's discovery of the valves in the veins and his work on development. We may think that it was here that the first seed that led to his discovery was sown.

On the 25th of April Harvey graduated from Padua and was created an M.D. with high honors. He returned to England in the same year and took his M.D. at Cambridge. This latter being a necessary step for admission to the College of Physicians which practically confined membership to graduates of English Universities or to those of a foreign University who produced testimonials of admission "ad Eundem" at Oxford or Cambridge. In 1602 Harvey was admitted a candidate by examination to the Royal College of Physicians in which he became a Fellow in 1607.

The conditions under which Harvey studied at Padua speak well of the hardy souls who underwent the ordeal . . . (1)

". . . food was scanty and bad, forms were rough, the windows were mere sheets of linen, which the landlord was bound to renew as occasion required; but to this Harvey was accustomed, for as late as 1598 the rooms of some of the junior fellows at King's College, Cambridge, were still unprovided with glass. Artificial light was ruinously expensive and there was an entire absence of any kind of amusement.

"The medical session began on St. Luke's Day in each year, when there was an oration in praise of medicine followed by High Mass and the Litany of the Holy Ghost. The session lasted until the Feast of Assumption, on August 15th, and in this time the whole human body was twice dissected in public by the professor of Anatomy. The greater part of the work of the university was done between six and eight o'clock in the morning, and some of the lectures were at daybreak, though Fabricius lectured at the more reasonable hour which corresponded with nine o'clock before noon."

In the same year that he was admitted as a candidate to the Royal College of Physicians Harvey married Elizabeth Browne. Little is known of Mrs. Harvey other than she was "tall, of a dark complexion and somewhat severe." The match was a good one, although childless, in that Elizabeth was the daughter of Dr. Lancelot Browne physician to Queen Elizabeth and later James I. It is questionable as to what influence Dr. Browne had on Harvey's later appointment to St. Bartholemews as he died the year following his daughter's marriage.

Harvey set up practice in London and took a house close to St. Bartholemew's hospital. In 1609 he was appointed assistant physician to St. Bartholemew's obtained through a letter from James I. This latter may have been given through the influence of Dr. Browne before his death but it is felt a greater part was probably played by Harvey's brother John who was a footman to James I, a position of much more importance then than to-day. In August of the same year Harvey applied for the position of Physician, upon the death of the existing physician Dr. Wilkinson, which was granted on October the 14th of the same year. He never lived within the bounds of the hospital although an official residence was supplied but continued to live in the original house he had taken in Ludgate. In consideration of this the Governors of the hospital agreed to increase Harvey's annual stipend from £25 to £33 6s. 8d.

From the time Harvey took up residence in London his practice flourished and he counted among his patients many in the higher walks of life. As a consequence of a lucrative practice he could very well have been content but as Dr. Van Wyck points out "He was not one of those who lived in poverty to benefit humanity and perhaps deserves all the more credit for surviving the distractions of prosperity"(2). It is to his insatiable curiosity that a great debt is owed since it led him on and the germ planted by Fabricius took root and grew. In this period he evidently was continually carrying out dissections and observations upon all kinds of animals for he dissected eighty different species. Hence from 1604 to 1615 besides being kept busy with his practice Harvey was also engaged in research.

In 1581 Dr. Richard Coldwell and Lord Lumley had established the Lumleian lectures at the Royal College of Physicians. It was a surgery lecture established at a cost of forty pounds a year and paid for by the founder's estate. In 1615 Harvey was elected on the 4th of August as the Lumleian lecturer. He was now only 37 and on April 16, 17, and 18, 1616 at Linacre's house on Knightrider street, the home of the Royal College of Physicians, he lectured to about 40 physicians of the College and a few laymen.

The manuscripts Harvey used for his Lumleian lectures have been preserved and are now in the British Museum. His handwriting is atrocious and this fact along with his habit of leaving sentences incomplete and interspersing English words with Latin make them difficult at times to read. In his notes as a preface to the lectures he listed eleven rules he laid down for himself when lecturing.

These include,

1. To point out what is actually peculiar to the body being dissected. (Anomalies and pathological lesions will thus not be lost sight of.)
2. To supply only by speech which cannot be shown on your own credit and by authority.
3. To cut up as much as may be in sight of the audience.
4. Not to praise or dispraise other anatomists, for all did well and there was some excuse for those who are in error.
5. To state things briefly and plainly yet not letting anything pass unmentioned which can be seen.
6. Not speak of anything which can be as well explained without the body or can be read at home.

In these lectures he dealt with the skin, outward form of the body, the abdomen and the thorax in their anatomical, physiological and pathological aspects. He devoted nine pages to the vascular system and it is here he first states his memorable discovery of the circulation of the blood. In his lecture notes Harvey had the habit of initialing ideas he considered to be his own. The following bear his initials,

> "It is plain from the structure of the heart that the blood is passed continuously through the lungs to the aorta as by the two clacks of a water bellows to raisé water.
> "It is shown by the application of a ligature that the passage of the blood is from the arteries into the veins.
> "Whence it follows that the movement of the blood is constantly in a circle, and is brought about by the beat of the heart. It is a question therefore whether this is for the sake of nourishment or rather for the preservation of the blood and the limbs by the communication of heart cooled by warming the limbs being in turn warmed by the heart." (3)

Here the notes on the heart end abruptly, and Harvey passes on to consider the lungs. Thus we see that at this time Harvey had discovered the circulation of the blood but he must have continued reinvestigating and substantiating his description of the circulation because it was not until 1628—12 years after giving it in the Lumleian lectures that the work was published in the form of a 72 page volume. Why he delayed so long in making the discovery public is not known although Sir William Osler advanced the suggestion in his Haverian oration in 1906 that Harvey like Copernicus dreaded the prejudices of mankind and so withheld the publication until 1628. It has also been suggested that the discovery was not mentioned in 1616 but was slipped into the notes at a later date. No evidence to substantiate this possibility is available.

In 1618 Harvey was appointed Physician Extraordinary to James I and upon his death in 1625 he held the same position to Charles I who raised him to the position of Physician in Ordinary in 1631. Harvey appears to have been on terms of warm friendship with Charles I and later accompanied him to Holyrood when the latter was crowned.

From the time Harvey became a fellow in the College of Physicians he was actively engaged in its activities and early attained high office. In 1613 he was elected a Censor a position to which he was reappointed in 1625 and again in 1629. As an annual appointment the duties entailed the supervision and government of all those who practiced medicine in and around London for a radius of seven miles. It also empowered them along with representatives of the Apothecaries to visit the shops of these people to search and show that the drugs and wares were wholesome and fit for sale.

A part of his time was engaged in duties of this nature but on the 3rd of December 1627 he was appointed to the still more important office of "Elect." The Elects were chosen from the most cunning and expert men of the faculty in London. There were eight of them appointed and from their own number they chose a president. Their function, a most important one, was that of examining candidates who wished to practice medicine throughout England and they certified their fitness by means of a certificate. The year following this ap-

pointment to the position of an elect Harvey was made Treasurer of the College but in this same year he was commanded by the King to accompany the Duke of Lennox in a tour through France and so had to resign his position. This disruption in his routine, the first since returning to England from Padua, continued until 1651 when he was again able to turn his attention and time to the activities of the College.

While in Paris with the Duke of Lennox, a contemporary physician Gui Patin playfully referred to the followers of Harvey as the Circulatoires. This is a corruption of the French Circulatoire meaning circulatory but in Latin it means quack or charlatan. It is not known if Harvey made any comment or not. Harvey's interest in anatomy still manifested itself as is evidenced by a letter he wrote to Viscount Dorchester, the Secretary of State in which he complained of the dearth of anatomical material. Around February of 1632 Harvey returned to England and was again interesting himself in the activities of the College. He left London again in 1633 when he accompanied Charles I to Holyrood, Scotland. In October of the same year he once again returned to London and once more was active at the College and St. Bartholemew's Hospital. At this time due to Harvey's constant attendance on the King, St. Bartholemew's created the position of a second Physician and gave Harvey leave to act as he pleased and be at the hospital when he was able and saw fit. Although very seldom in attendance at the hospital Harvey continued to receive his £33 6s. 8d. as did the newly created second physician.

In 1635 the Earl of Arundel brought a Thomas Parr, who was reputed to be 152 years of age, to London, to show to the king. This was surely a "remarkable sight" for the King but unfortunately the London life was too much for "Old Parr" and he died, with Harvey, at the command of the King, performing the post mortem. In this way Harvey met the Earl of Arundel and in the following year, 1636, he became the Earl's personal physician and was chosen to accompany the diplomatic mission headed by the Earl, to Vienna. Harvey was now fifty eight years old and as the Earl remarked he was still in search of specimens. While on the continent Harvey wrote to Caspar Hofmann then professor of Medicine at Nuremburg, offering to demonstrate his doctrine of the circulation of the blood as Hofmann hadn't as yet received it. The public dissection convinced everyone except Hofmann, which so annoyed Harvey that he is said to have thrown down his knife and left the theatre. From 1636 to November 1638 Harvey spent his time travelling around Europe. He evidently was extremely active in his travelling, so much so that the Earl became worried about him and in a letter to the Reverend William Petty at Florence he effectively describes Harvey by asking "I do hope I shall see the little perpetual movement called Dr. Harvey before my going."

When he actually returned to London is not known nor is anything available as to his activities for the next two years or more. It is presumed he was attending to his duties at St. Bartholemews as well as to the King. The latter as history tells us was fast getting himself into trouble with his people and preparations were being made for war.

In 1642 Harvey's public fortunes fell along with the King's with the siege of

parliament against Charles I. His home was sacked and much of his work on insects was destroyed. Parliament gave his position at St. Bartholemews to another man. These vicissitudes did not however alter him and his interest in anatomy and the natural sciences. He left London with the King and took part in the battle of Edgehill in October 1642 not far from Oxford and at the same time took care of the two young princes who later became Charles II and James II. After the battle he took up residence with the King at Oxford itself. While here in spite of the events taking place around him he still carried on dissections and is known to have observed the development of the chick. He was made an honorary M.D. at Oxford as well as being appointed by the King Warden of Merton College. When Oxford surrendered in 1646 Harvey returned to London while the King escaped disguised as a servant. While in London he stayed with his brothers in turn all of whom were reasonably wealthy from their endeavours as merchants and their trade with Turkey.

This marks the period of Harvey's withdrawal from public life and the relative obscurity was claimed by Harvey to have been a boon to him. He was thus able to carry out many investigations, particularly in the line of Generation. This work was published in 1651. In it he states his belief that all animals are produced out of ova and he carries the reader through the stages that can be seen with the naked eye and by the use of a magnifying glass. With no microscope available it is amazing the insight and perception Harvey displayed.

From 1651 Harvey spent most of his time engaged in activities associated with the Royal College of Physicians. In 1630 he had subscribed £20 toward the purchase of a site for a library for the College. In 1632 he had drawn up a set of rules for its governance. But in 1651 an anonymous offer was made to the College asking if they would permit the building of a library for them. Naturally they readily consented and in tacit admission of whom the donor was, they erected a statue to Harvey, commemorating his discovery of the circulation of the blood. Unfortunately both the library and the statue were lost in the Great London fire of 1666. The library opened on February 2, 1652 when Harvey welcomed the College with a great feast and made over the title deeds.

In 1654 the college chose him as their President, the only office he could now attain to, but he declined owing to old age and poor health but suggested in his stead the re-election of Dr. Prujean. This the College promptly did.

During this time, from 1613 Harvey had been giving the Lumleian lectures but he now resigned on July 28, 1656 and said good-bye to the Fellows. Upon leaving he made over to the College his paternal estate at Burmarsh, Romney Marsh, Essex. His object in this was threefold; first, to establish an annual feast; second, to found an annual oration at which the benefactors of the college should be remembered; third, to provide for a librarian who would also have the museum under his care.

The oration is still carried out, the first was delivered in 1656 and up to 1865 was given in Latin. The library contained a wonderful collection of Medical and other classics along with works on Geometry, Geography, Astronomy, Music, Optics, Natural History and Travels, all furnished by Harvey.

On 3rd of June 1657 as the sun went down, William Cushing Harvey died of cerebral palsy at Roehampton at the house of his brother Eliab, but left behind what is often considered to be the greatest contribution to physiology ever made.

Harvey's Time

England at the time of Harvey's birth was reaching the zenith of the Tudor period that culminated in the reign of Elizabeth I. The Spanish Armada of 1588 when Harvey was ten, did more to weld the people into a single political and national entity than anything that had preceded it. Imbued with the confidence the defeat of the Armada engendered England replaced Spain as the leading colonial power. A rapidly expanding commerce had greatly increased the wealth of the country and raised the standard of living. England at the time Harvey left for Padua was quickly taking her place as a leading nation of Europe.

The period is one of literary, scientific and political reawakening. The cloak of the dark ages had been thrown off in the late 15th and early 16th centuries. Learning and scientific thought had felt the force of this new impetus. In England, Shakespeare, Marlowe, Beaumont and Fletcher led the field in Literature. Bacon had laid the foundation of scientific thought in his Novum Organum. Men were slowly beginning to question the thought and teachings of the ancients. They were feeling and following the force of the reawakening. Preceding Harvey were such great men as Leonardo di Vinci, Leonard Fuch, Copernicus and the first systematic book on Anatomy in 1543 by Vesalius. The cornerstone of the age was laid by Sir Francis Bacon when he stated, "I do not endeavor by triumphs or confutation, or pleadings of antiquity, or assumption of authority or even by the veil of obscurity to invest these inventions of mine with any majesty" but rather, ". . . I lead (men) to things themselves, and the concordances of things, that they may see for themselves what they have, what they can dispute, what they can add and contribute to the common stock."

However, it was not easy to throw off the force of authority. Religious struggles and wars are strong testament to this. Many had suffered and died for presuming to question authority, be it religious or scientific. The authority that Harvey questioned was that of the great Galen. The circulation of the blood had intrigued the curiosity of men from earliest times. The pre-Hippocratic Greeks and Egyptians had written about the pulse in disease. The relation of the heart movements and the peripheral pulse was discovered by Aristotle's time. Aristotle himself thought the heart had only three chambers; this from the fact that the animals he used had been strangled to death in consequence of which the right auricle was greatly distended so that he thought it part of the venous system. He concluded the heart movements were due to a vital force diffused to the heart in some way from the vessels about it. A nourishing factor he felt was obtained by the vessels from the liver. It was also considered that the arteries contained air and the veins blood. The latter entered the arteries after death by backward flow when the air left them. The Galenical school admitted a pulmonary circulation but this was incidental. Blood was formed by absorbed food from the alimentary tract being carried to the liver via the Vena

Porta. Here the formed blood was endowed with "natural spirits" and carried to the right heart via the Inferior Vena Cava. Some blood passed to the lungs but the majority went to the ventricle through invisible pores in the interventricular septum. As the heart dilated air was drawn from the lungs into the left ventricle. The crude blood, air and innate heat of the heart served to endow the blood with vital spirits. Blood moved by a tidal ebb and flow in the body and the possibility there was a constant and measurable blood volume moving in a circle was never dreamed of or considered.

Such was the opinion held by Medical men and others for 1000 years and the authority and belief Harvey questioned and overthrew.

Harvey the Man

Harvey as a man was not in physical terms "a great Man." Rather he was a little man and his personality appears to reflect this physical deficiency. Given to making pungent or drily humorous remarks he cannot be said to be truly humorous. The incident concerning the Harveys' parrot points more to scientific interest and belief in fact than to humor. The Parrot had always been considered to be a male but upon its death when Harvey carried out an autopsy to discover the cause of death he found an egg in its oviduct. The incident is related more from a scientific standpoint than as a joke upon himself and his wife.

In appearance Harvey is described as being of the lowest stature, round faced, olivaster complexion, little eyes, round, very black and full of spirit. His hair was black as a raven but turned very white twenty years before his death. He was very choleric and wore a dagger upon which he evidently rested his hands when talking and would often withdraw it and handle it while talking. This has led some of his biographers to feel that Harvey was aggressive and not averse to using it. Most evidence however seems to suggest this was a habit much as we doodle or rattle a bunch of keys.

He absolutely declined to enter the arena of controversy over his discovery but preferred to pursue undisturbed his peaceful course of medical practice and scientific investigation. He was known to remark that any who doubted his work had but to investigate the matter himself to verify that what he said was truth.

In his researches he worked for his own satisfaction rather than notoriety and in knowing he was right. He appealed to his critics to apply the art of observation and the recording of this observation.

After his death in 1657 Harvey lay from June 3 till June 25 in London when Eliab his brother had him buried at Hempstead in Essex 50 miles from London in the Harvey Chapel. The body was wrapped in lead roughly shaped to the form of the body with an inscription on it in raised letters. In 1868 a committee of the College headed by Sir Benjamin Richardson recommended the removal of Harvey to Westminster Abbey. This would probably have occurred except for the death of Dr. Stanley, Dean of Westminster who was thought willing to have Harvey's remains placed near Hunter or Livingstone.

When this recommendation fell through Harvey lay in the Harvey Chapel until St. Lukes Day, 1883. In the intervening 226 years holes had ap-

peared in the leaden suit so that little was left of Harvey's actual remains. What was left however along with the leaden shell was removed to a sacrophagus built by the Royal College of Physicians in the chapel at Hempstead.

So today Harvey's remains restored as far as possible to their original state lie at Hempstead in Essex. High in the wall of the Church above them is a marble monument containing a bust of Harvey with an inscription testifying to his good works.

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ANSWERS

1. In jaundice, if due to pressure on the common bile duct from without, the gall bladder is greatly distended. When the common bile duct is obstructed by a stone, dilatation of the gall bladder is rare.
2. The energy set free at each contraction of the heart is a simple function of the length of the fibers composing its muscular walls.
3. The least perceptible difference between a series of stimuli is in each instance a certain constant fraction of the preceding stimulus.
4. The weakest stimulus that is capable of causing a contraction of heart muscle at all will produce the maximal contraction.
5. These laws were postulated by Robert Koch as essential requirements for the identification of the micro-organism which is the etiological agent in any particular disease.
6. Ontogeny recapitulates phylogeny.
7. The pulse rate is inversely related to the arterial blood pressure.
8. In the inheritance of certain traits the offspring are not intermediate in character between the parents but resemble one or the other parent in this respect.
9. Normally, the more sugar that is ingested the more is utilized. In diabetes the reverse is true.
10. When the cervix is hard as one's nose, pregnancy does not exist; when it is as soft as one's lips, pregnancy is probable.

J. WAGNER

MEDICINE AND SOCIAL WORK

MEDICINE AND SOCIAL WORK: one might ask is there kinship within these two professions; what is the nature of this kinship and how can it be effectively strengthened? Basically, medicine and social work are concerned with the welfare of man. The welfare of man presupposes a knowledge of man and the idea that man can achieve a state of well being presupposes a society in which this ideal of well being is considered important and possible.

When we think of social work in relation to the broader issues of human well being, we learn much from reviewing its growth and development. We all know the painfully slow steps which led to society's realization that human ills could not be punished or outlawed out of existence. Centuries elapsed before human ills were divided into the neat categories of poverty, crime and sickness. Many more years were needed before the emphasis changed from the category to the persons within that category; from poverty to the poor; from crime to the criminal and from sickness to the individual with the disease. Similarly any history of medicine tells an absorbing story of changing attitudes toward health and disease, changing attitudes toward the treatment of disease and above all changing ideas about the person with the disease.

The person with the disease is of prime importance to both the doctor and the social worker who chooses to work in a medical setting. The early writings of great physicians and the more recent "early writings" of skilled social workers emphasize that disease cannot be looked upon as an entity which can be divorced from the sufferer and studied by itself. Man is both a biological and a social being and the broadening concept of medicine extends to a knowledge and understanding of man as a social being as well as a knowledge and understanding of the society in which man has his being. This inclusion of the personal, emotional and social factors within the broad concept of medicine is as old as Hippocrates and has been inherent in the "healing art" of any age.

Obviously, the immense strides made by medical science; the ever increasing body of knowledge to be mastered by the medical profession and the broadening concept of health to include "a state of physical, mental and social well being" places a seemingly impossible burden on the doctor of today. One of the ways in which this burden can be lightened lies in the team approach to this gigantic task. The team approach is a well established one within the medical profession itself and within the medical and nursing professions. In order to meet the total needs of the total person in our complex society today, however, the treatment team in a hospital, clinic or medical care program should also include persons whose special training, knowledge, understanding and competence lie in the field of social welfare.

Let us look briefly at the training which underlies the social worker's knowledge, understanding and com-

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petence. The student in social work undertakes a two-year post-graduate course, and the training program is two-fold; theoretical and practical. Part of each week is spent in the class-room, the remainder in a community social agency or a hospital social service department. Through lectures and seminars the student learns in theory about man, the society in which man lives, and the principles by which we, in social work, meet the needs of man, individually or in groups. Through experience in a social agency or hospital social service department, the student learns, with the help of supervisors, to apply his theoretical knowledge to the problems of the person needing help. This part of his training is similar to the interneship of the medical student in that it brings the student into direct contact with the person and his need.

Through the combined class room and agency experience the student learns about the human personality and the meaning of human behavior. He learns how one person reacts on or to another. He learns about the need that we each have for love, encouragement, success; how the lack of these affects our outlook, our relationships and our attitudes. He learns about the influences of family, of job, of play-time activity and sees the importance of these in the lives of the individuals he is helping. He acquires an appreciation of how it feels to move from one culture to another, from one social group to another, or to be faced with re-arranging one's life as a result of illness, disfigurement or deformity. He learns about the social agencies in the community available for helping the person solve his problem and about the social legislation which has produced and guided the development of those agencies. The student social worker also learns how his own personality, attitudes and skills can make or mar his ability to help the person with his problem, just as these also influence the doctor's work with his patient.

In the first year of training the social work student is taught basic knowledge about man and society. In his second year he has an opportunity to study the subjects associated with his own special interest. Just as a doctor may prefer paediatrics, surgery or psychiatry, so the social worker has in the second year of study, a choice of specializations such as child care, family service, medical or psychiatric social work.

When the student has completed his two years of study he is eligible for the degree of Master of Social Work. The Bachelor of Social Work is awarded to students who complete the first year of study only. It should be emphasized that the Bachelor of Social Work does not represent full training for social work but many students find it difficult to finance two consecutive years of post-graduate study. Because the demand for social workers far exceeds the supply many social agencies are eager to employ students who have completed only the first year of their training.

Like all other social workers, those who work in a medical setting are trained to deal with individuals in need, to help these individuals understand their needs and to obtain the help indicated for them. Like all social workers, they are skilled in seeing the individual in relation to his family and all the circumstances of his environment, and in using community resources to help him work out his problems. But unlike the social worker in a family or a children's agency,

the social worker in a medical setting works constantly with sick persons.

Social workers in medical settings help patients with problems related to their illness and they gear their help primarily to the patients' needs which are medical-social in nature. The patient's need may arise from his inability to make the most use of the medical care offered because of personal or environmental difficulties. It may arise, too, from the patient's inability to profit from medical care because of his own or his families attitudes and feelings or because of lacks in community resources or the lack of understanding and cooperation on the part of teachers, employers, etc.

The primary purpose of the hospital is the safe-guarding of life and health. Together with the other members of the hospital team the social worker takes part in the total treatment planning for the patient. Whereas the doctors, nurses, physiotherapists, and other members of the team are bent on the prevention and cure of physical disease, the social worker concentrates on the social and emotional problems generated in the patient and his family by the disease, its treatment and its residuals.

The Social Worker's Role With the Patient

Illness strikes at the person in his entirety, not only at the part immediately affected by the disease process. While the medical staff work toward restoring the patient's physical well-being, the social worker works with the patient's reaction to being ill and with those problems which come with illness. The patient's personal responses to disease and treatment may stand in the way of his recovery, and it may not always be possible for the worker to dispel these fears and misconceptions by simple reassurance. The need to understand the underlying causes of a patient's attitudes which may be obstructing his road to recovery is shown in the following situation. A fearful patient refused medication on the grounds that she thought it was habit-forming. She could not be prevailed upon to change her mind until the social worker learned that a member of her family had become a drug addict. In the light of this information it was possible to deal with this patient's fears realistically and constructively.

Many acute illnesses require painful or frightening treatment measures. Such procedures as lumbar punctures and intravenous injections while routine to hospital staff, can be intensely frightening to the ill person. Often patients react to this fear by offering a passive resistance to all treatment measures, since this is the only weapon they have in their helpless state. One finds this frequently in the hospitalized child where resistance to treatment may spill over into a generalized refusal to conform to routines. This would include refusal to eat or have temperature taken, protestations against injections or similar procedures. It is common to regard such behavior as the lack of cooperation of a "spoiled" child, when actually it is a frightened child's attempt to defend himself against treatment, which he is told will help him, but which he sees only as a source of pain and discomfort. The medical staff whose responsibility it is to protect the patient against the disease are apt to be so burdened by this responsibility that the patient's resistance is seen exclusively as something which prevents adequate treatment, while the underlying causes of the patient's emotional state may be largely ignored. It

is here that the social worker, who is not in a position of authority to the patient, may permit him to bring his fears into the open and help him to an increased feeling of confidence in the care he is receiving in the hospital. Similarly, the social worker may be called upon to help a patient tolerate restrictions imposed by a medical condition, by treatment or by convalesence. Not every patient has the self-discipline to adhere to a strict diet or a regime of limited activity. Chronic conditions such as diabetes, cardiac disease, arthritis, or progressive neurological conditions impose drastic changes on the individual's way of life. The social worker's role is to help the patient live the most normal life within the limitations of his disease and disability. She does this often by helping the patient concentrate on and use what function and vigor he has left rather than on what he has lost. Lastly the social worker may be called upon to deal with financial worries arising from the illness; this may involve referral to community agencies where assistance is available.

The Social Worker's Role With the Family

The relatives of the ill person may experience the same feelings of fear, strangeness and helplessness as the patient himself. This is especially true of the parents of sick children, where in many cases the parent could probably tolerate an illness of his own with less strain than the illness of his child. Relatives visiting on the ward may press to have their urgent questions answered by the nurse and doctor. Their visits and their anxious questioning may at times complicate efficient hospital administration. The reassurance which can be realistically given to relatives is time consuming and often patience taxing. Since relatives communicate their fears, dissatisfactions and misconceptions to the patient, however, it is important that someone meet upset relatives with understanding and acceptance. If the social worker is able to give the family a sense of their own importance in helping the patient, it will reduce their feelings of helplessness in the hospital setting where others have taken over the responsibility for the patient's care, and where they may themselves feel unnecessary or even unwanted. It may also insure future cooperation in planning for the patient's after-care. In illnesses of psychiatric or psychosomatic nature especially, planning with the relatives becomes one of the most important aspects of the total treatment; for if the family cannot provide the patient with a healthy environment on his return home he is unlikely to sustain the improvement achieved in hospital.

Families need considerable help in accepting conditions with uncertain or unfavourable prognoses. To illustrate—a patient was struck with sudden blindness of undetermined origin, and admitted to hospital. A period of weeks would elapse before it could be ascertained whether this patient would regain her vision. One can imagine the panic of the parents who were faced with the possibility of having on their hands a daughter who might be totally blind for the rest of her life. Such parents are badly in need of the continuing support which the social worker can provide, they need help in order to face the prognosis and to carry out plans for their daughter's training as a blind person should that be necessary.

The Social Worker's Role With the Doctor

The worker should be in a position to give the doctor a picture of the patient's social situation; where he came from and what he is going back to; what kind of a person he was before he became ill; and how much help and strength can be expected from the relatives. Through her close personal contact with the patient and his family she should relate to the doctor her impressions of the patient's total personality; how much stress he can tolerate, how much reassurance he may need, how likely it is that he will carry out the treatment measures, or conform to restrictions. This involves informing the doctor of any personality problems the patient may have which might effect the illness or the patient's reaction to it.

In hospitals where the social service department is well established, the doctor makes himself responsible for referring patients to the social worker when need arises. Such referrals can be acted upon most adequately if effected as early after admission as possible. The understanding of the social problems related to a patient's illness and medical care takes time and for this reason social workers sometimes feel the impatience of their professional colleagues.

Relationship between the social worker and the patient is established during the interviews with the patient. Not all patients move at the same pace in revealing their problems or in arriving at decisions about them. Frequently social workers are looked upon as people who "give advice" or who "tell the patient what to do". Any plan which the patient himself has not entered into, understood and wanted is doomed to certain failure. Social work is not a "doing for" or a "doing to" but a "doing with".

The Social Worker's Role in the Community

Episodes of acute or chronic illness can create problems which necessitate the hospital or medical social worker's contact with other community agencies and institutions. Financial difficulties may well head the list. In such cases the patient must be brought in contact with welfare departments or family agencies. In the case of illness of a mother the care of children at home may be the biggest problem. Child welfare agencies, nurseries, day care centres, etc. may then be called upon to assume care of the children until the mother has regained health. For a person on a restricted regime or with orthopaedic, neurological or psychiatric handicaps, employment problems abound. In situations of this kind the special services of the National Employment Service provide individualized counselling. Specific associations such as the Cancer Society, The Canadian Arthritis and Rheumatism Society, the Diabetic Association, the Polio Foundation, etc., are also geared to give many forms of assistance. The medical social worker keeps in close touch with public health and bedside nursing services which are an important part of the resources available to the patient.

In summary it may be said that the complex structure of the modern hospital makes it difficult to individualize the patient, to integrate the many services open to him, and to provide continuity in personnel administering to him. It is not possible or necessary for any one department in a hospital to do all the individualizing of patients. In

patient-centred hospitals many hospital personnel treat the patient as a person. The social worker, however, is that person in the life of the patient who helps him cope with the individual problems which he faces through his illness—problems relating to himself, his family and his use of the hospital; problems relating to his school or place of employment. Recognizing how the patient's illness upsets his own and his family's way of living, it is the social worker's task to help him achieve some measure of emotional balance in the situation of crisis in which he finds himself; to use medical care fully and to profit from medical treatment and post-discharge care.

Follow-up and After Care of the Patient

"What the hospital has done for a patient can really only be judged by what happens to the patient afterwards."

The medical social worker directs her efforts toward the return of the individual patient to the community. This presupposes that a plan for follow-up will be formulated shortly after the patient's admission, provided that the doctor feels that there is need for this planning early in the patient's treatment period. An adequate follow-up or after care program is based on the conviction that the hospital's responsibility for the patient is fulfilled only when he has obtained his optimum health, and efforts made through follow-up are aimed at his maintaining this state of health in order to be able to resume his place in the community.

"Upon the social service department rests the major responsibility for helping the patient deal with those obstacles within himself and his environment that stand in the way to the fullest achievement of his purposes."

The medical social worker tries to understand the patient's social problems in relation to his disease as well as in relation to his family, cultural, emotional and economic background. Many patients reveal their social problems only at the point of discharge, if the medical care they have had is to be fully effective, the worker may have to give help to the patient after he has returned to the community. Often many persons will be involved in planning adequately for the patients after care and for this reason it is often necessary for the social worker to follow the patient for a brief period to ensure the plan's full success.

Public relations between the hospital and the community are strengthened by the hospital or medical social worker who has a unique and continuing opportunity to interpret the services of the hospital to many individuals, service groups, committees and social agencies. The social worker, through his participation in study groups and local committees may play a part in furthering social action which may be directed to meeting the unmet social needs of ill people. Particularly he has responsibility for helping the community to understand and to meet the needs of the patients discharged from hospital with chronic, progressive or disabling conditions. The period immediately following discharge is often an extremely important one for the patient and many community resources are called upon to help him through those days when he is re-establishing himself either at home, in a nursing home, an institution or back at work.

The social worker visiting the patient in his home after discharge is his link

with the hospital. The social worker may find uncertainty surounding instructions for the patient's care or he may find that the family, through misunderstanding, fails to see the need to carry out the physician's instructions. Because the patient and his family already know the social worker he is often able to encourage them to persevere with special diets, protheses, reorganization of job and living arrangements. Sometimes families do not see the need of "upsetting the house" in order to provide a ground floor room for a heart patient, for example. Support, encouragement and interested clarification can sometimes make the difference between successful convalescence ending with a return to productive living, and a patient's relapse and readmission to hospital.

Patients' post discharge problems also include those directly associated with the nature of his illness. Families, friends and even the public at large may show some rejection of the patient who has had care in a tuberculosis sanatorium or a mental hospital. Epilepsy and neurosurgical conditions also may result in the patient finding he is no longer welcome in his boarding house, at his work or even in his own home. Loss of friends, companionship, economic insecurity and unemployment may face some patients upon discharge and it is then that he needs the understanding, practical help of the trained social worker.

In conclusion, may we quote from a social worker who began her work with ill people in 1905 when a great physician, Dr. Richard Cabot, saw social work in hospitals as an important and necessary part of total medical care.

"So we see that both medicine and social work today face responsibilities to promote better education for the social obligations of their professional personnel: medicine, old and disciplined, but with courageous leaders who see a widening range for public service in clear view; social work, young and vigorous, facing the necessity to clarify its special function and standards and bring its aims into sharper focus as a basis for a comprehensive educational program. Both professions face issues that involve public policy; medicine, for leadership in making its services available to the people; social work, in tackling obstacles to the realization of our declared ideals for decent standards of life and equality of opportunity for all".

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EDITORIAL

FINALE

One of the most pleasant duties of any Editor is to acknowledge the efforts of the staff with which he has had the privilege of working. It is with a deep sense of gratitude that we do so at this time.

Personal time and enthusiasm are two very cherished commodities in a medical course, yet these have been given freely by every person whose name appears on the Journal masthead, solely in the interest of publishing a student volume which will compare favorably with its predecessors, without any thought of personal recognition or recompense. To all of these people the Editor is very grateful.

Mr. Hall of the University Press, and Mr. Hart of the T.G.H. Lecture room are two of the many people, who while not on the Journal staff officially, contributed very greatly to its production and distribution.

Finally, we would like to welcome the new Editor who is to have charge of Volume XXXI, Miss Jean Griffin, of 5T4. It is a tribute to Miss Griffin's accomplishments, that she will be the first female editor of the Journal, and having spent 5 years on its staff should give valuable experience to the succeeding Volume. We are sure that in her hands, the future of this Medical Journal will be secure.

THE TREATMENT AND INVESTIGATION OF ALLERGIC SKIN DISEASES*

H. J. WATT, 5T3

Introduction

Those diseases to be considered as having an allergic basis are:

(1) Contact Dermatitis
(2) Urticaria
(3) Infantile Eczema
(4) Atopic Dermatitis
(5) Drug Eruptions

Before discussing these diseases individually, we should consider the three basic methods of handling allergic diseases.

(a) *Removal of Offending Allergens*

This is accomplished by the use of elimination diets for food allergens, by dust-free rooms and air-conditioning for inhalants and by the elimination of all contact allergens.

(b) *Hyposentization Against Known Specific Antigens*

This treatment is based on the assumption that the injection of small quantities of antigen in increasing doses, increases the circulating antibodies. Loveless demonstrated a close relation between the height of antibody response and the relief from symptoms.

Whether complete desensitization can be achieved is questionable. However, complete relief of symptoms occurs in 20% and the majority of the rest have their symptoms reduced by about 75%. Some are made worse. Clinical hypersensitivity rapidly returns once the injections are discontinued and in order to maintain a high degree of hyposensitivity the person must remain more or less constantly in contact with the allergen.

This method is rarely used for food and environmental allergens except pollens and house dust. Milk and egg sensitivity, however, can often be reduced by feeding small quantities of these foods before meals.

(c) *Decreasing the Responsiveness towards the Offending Allergen*

There is considerable evidence that the allergic response can be decreased by a variety of non-specific means. This would include psychotherapy, hormone therapy, dehydration, sodium restriction and potassium administration. Sedatives, antispasmodics and anaesthetic drugs may allay the allergic response. Many other such measures have been tried and some of them will be mentioned later.

Contact Dermatitis

The basic principles in the management of this condition are to remove the cause and provide symptomatic relief until the skin heals.

If exposure has occurred within a few hours and the reaction has not yet begun, then an attempt may be made to remove the irritant from the skin. Soap and water are the most successful but chemical neutralization may be used in special instances, e.g. sodium thiosulphate for iodine and chromates. Next

*From a paper delivered to the A.O.A. Society.

it must be ensured that the patient is protected from the causal agent. If this substance is *not* known, then all potential sensitizers must be eliminated.

Symptomatic Treatment

Relief of the itching that is present is the major objective. The simpler the local applications the better. White petrolatum, covered with clean towels soaked in cold water, makes an excellent dressing. This acts as a blotter absorbing the exudate, thus preventing the skin from becoming soggy and macerated. Aluminum acetate, salicylic acid and potassium permanganate may also be used. These medications should not be allowed to dry on the skin lest the increase in concentration prove irritating. During the sub-acute stage lotions are best, and to these are added the various antipruritics such as phenol and menthol. In the chronic stage, when there is thickening and lichenification, depth of action and a keratolytic effect are needed. Therefore, ointments containing tar derivatives, salicylic acid, resorcin and chrysarobin are used.

If there is an urticarial element present, benadryl and other antihistaminics are helpful. X-Ray which desensitizes locally will give three to six weeks of relief. In severe cases, splints may be necessary to prevent the patient from ripping his skin to shreds. Intravenous local anaesthetics have been used in an attempt to control the itching. Beneficial results were not obtained with novocaine and only moderate success occurred with procaine hydrochloride. Lowenthal reported an immediate suppression of symptoms in cases of eczematous dermatitis including contact dermatitis when sulphapyridine or paro-amino-benzoate were given. This work, however, has been largely discredited. Simon stated that Vitamin B_{12} might be worth a trial when other measures failed. Desilva found that citrates has a potent inhibitory effect on the release of histamine due to an action on the activation of the precursor. He suggested that more work be done to prove or disprove his claim that these substances are effective in the treatment of contact dermatitis.

The action of A.C.T.H. and cortisone has been investigated by many authors. A.C.T.H. seems to have a beneficial effect on the delayed type of tissue response which would include contact dermatitis. Thus, recovery will be speeded, relief usually beginning about the third or fourth day of therapy. If no further exposure occurs, the cure will be lasting, if exposure is continued the lesions will recur shortly after discontinuing the treatment. Remissions may last from a few days to a few months. Maintenance therapy has not yet been attempted.

Desensitization, either specific or nonspecific, has been of very little value.

Secondary infection of this and the other conditions to be considered will be well handled by vioform or bacitracin ointment. Some workers believe that a course of staphylococcus toxoid should be given.

Prophylaxis is of course very important. The provision of good working conditions and adequate washing facilities will cut down the incidence of industrial dermatoses. Gloves, detoxifying agents and protective ointments may also be used.

Investigation

A careful, sharply focussed history, although tedious and time-consuming, will in the majority of instances point to the

offending substance. Patch testing is very valuable in this condition and will be considered later under the heading of skin tests.

Course and Prognosis

As a general rule, the disease is self-limited if the allergen is removed from the patient's environment. The occasional case will continue having recurrences despite all attempts at therapy. Eruptions of the hands, feet, eyelids, scrotum and groin are particularly resistant and the most difficult to manage. Spontaneous remissions may occur at any time, the duration of the disease varying from days to years.

Urticaria

ACUTE FORM

Since foods are a common cause, a saline cathartic may be given at the outset. The food intake is reduced, a bland diet given and fluids forced. Oral absorbents such as kaolin or animal charcoal can be used.

Local Measures

Any or all of the following may be used in an individual case—

(1) Phenolized calamine lotion, menthol or 2% alcoholic solution of tar for local dressings.
(2) Saturated sodium bicarbonate or carbonate compresses.
(3) Baths of isotonic sodium or ammonium chloride.
(4) Camphor or thymol rubbed on the bedding or clothes.
(5) Medicated soap, salves, wool and irritating local applications should be avoided.

Systemic

Coffee, aspirin and alcohol should be avoided as they may cause a flare or recurrence of the lesions. Relief of fatigue may prove beneficial. To delay absorbtion of possible food allergens hydrochloric acid is given before meals.

Antihistaminics are often suppressive and often control itching. Some people however prefer the hives to the all in feeling they get with this therapy. Epinephrine will afford immediate and complete, but transient relief. Intramuscular injections of adrenalin in oil may suppress further eruptions. Atropine, ephedrine and other sympathomimetic drugs have been advocated by other authors.

Sedatives, such as the barbiturates, are useful but dangerous, because of the hypersensitive state. Morphine and the other opium derivatives are contraindicated because they affect the small blood vessels of the skin.

Specific desensitization can be carried out by feeding small quantities of the offending food before meals. The complicated procedure of giving intradermal injections of proteoses, prepared from the urine during an attack of hives, has never been successful.

Non-specific desensitization—Numerous methods have been tried, including calcium injections, autohemotherapy, foreign protein (typhoid), large doses of iron, nicotinic acid, bile salt and cascara.

CHRONIC FORM

This often taxes the resources of the attending physician. All the above procedures apply equally to this form but there are additional problems. All possible causal drugs and foods must be discontinued. A search must be made for parasitic infestation or a focus of infection. Eradication of these may effect a miraculous cure. Chronic urticaria may be secondary to such diseases as

leukaemia, Hodgkin's, hyperthyroidism and blood dyscrasias. Improvement of these conditions often makes the uticaria disappear.

ACTH and cortisone seem to have little or no effect on the immediate type of reaction, where there is a quick release of histamine from the cells. Further cortisone does not interfere with the action of histamine on the blood vessels. Therefore it would follow that these hormones would have a doubtful effect on urticaria. However, rapid and complete relief of symptoms has been reported with the use of these substances. The effects are of brief duration.

Investigation

In this disease the shock organ is the small blood vessels and thus the etiologic agents are distributed by the blood stream. Further, the agents are commonly the larger and more complex protein allergens. These factors are important in attempting to determine the etiology.

A careful history and observation of the clinical course again yield the most valuable information. Scratch, intracutaneous and passive transfer tests are often of little or not help, probably due to differences between the conditions of the test and clinical exposure. These tests are only used as an additional check on suspected substances or as an ultimate measure to determine the allergens. Finally, there are the various forms of diets. Of these the additive type is the simplest and is less likely to give false results than the harder to manage elimination diets. Difficulty arises if the appearance of the urticaria is delayed. Drugs, inhalants and contact allergens are also posible causes and should be included in the investigation.

Course and Prognosis

This disease will often pursue a chronic recurrent course unless the cause is found and eliminated. General health is not threatened unless oedema of the glottis occurs.

INFANTILE ECZEMA

The parents should be reassured that the skin condition is not contagious, that the baby is healthy and that the skin will clear completely by two years of age. Further, much of the improvement witnessed when these babies are brought into hospital has been attributed to removal of the parents.

Local Treatment

Scratching should be prevented by the use of restraint jackets, arm splints or cardboard rolls over the elbows. External iritants such as wool, fur, dust and cigarette ashes must be avoided. Soap and water are definitely contraindicated, the skin being cleansed with mineral or olive oil. Bran, oatmeal, potassium permanganate or sodium sulphate baths may be given. Starch poultices are used to remove the crusts before the local medicaments are applied. Of these the tars seem to be the best, especially the crude form. Icthyol or 4% resorcin may be substituted. For lesions on the face Lassar's paste containing crude coal tar is applied by means of a face mask. In general, lotions are used for oozing lesion and ointments for dry.

General Treatment

Sedation is given as sodium amytal per rectum or phenobarbital with meals. Antihistaminics will afford palliation in some cases. Blood transfusions may be necessary (Wolfe). Specific desensitization has been variously reported as being

of no value or working in almost all cases. It is worthy of a trial if other measures do not control the disease. Osborne and Walker, by eliminating all contact and environmental allergens, effected a cure in half their cases and helped two thirds of the remainder. A good percentage will clear with any radical change of environment such as coming into a hospital. This has been attributed to a stress reaction with stimulation of the adrenal cortex. After staying in hospital some time the lesions tend to reappear concurrent with the adaptation to the stress situation. Similar to this is the production of local inflammation by repeated injections of pertussis vaccine.

The dietary measures used are a mixture of treatment and investigation. It must be remembered that it is very important in these infants to maintain proper nutrition during the period of food testing. The basic diet to be used is controversial. All agree that milk, along with eggs and wheat, are among the common offending agents. Soybean emulsions, reheated evaporated milk and meat milk all have their devotees. Single, simple foods are added at weekly intervals to see if they will cause an exacerbation. It is interesting to note that meat and most vegetables are safe. Orange juice and fish oils are not given during the period of testing, vitamins being supplied as cevitamic acid and aqueous extract of vitamins A and D.

In families where there is an allergic diathesis special precautions should be taken. The diet of the pregnant and nursing mother is controlled so that she avoids foods that might sensitize the baby. In the newborn period, if the baby is to be breast fed, cow's milk should not be given at all, lactose water being used until the breast milk is adequate.

On the rationale that there is a deficiency of unsaturated fatty acids in these children, diets high in these substances have been given. Good results were reported by Hansen, the originator of the idea, but have not been substantiated by other authors.

Cortisone and ACTH will in the majority of instances effect total or partial clearing of the skin, with control of itching. This effect is only temporary. These substances are not used until all other forms of therapy have been tried and all investigations carried out. They are then used to

1. Control severe exacerbations.
2. Permit orthodox forms of therapy to gain control.
3. Treat exceptional cases not responding to orthodox forms of therapy.
4. Clear the skin temporarily to allow skin testing.

Investigation

The value of the scratch and intracutaneous test is controversial. The percentage of good results reported varies from 0 to 90%. Cooke was very much against these tests, for as he stated—the response to the tests is a wheal and eczema is not a wheal reaction. In general it may be said that skin tests are useless from birth to six months and work fairly well from six months to one year. The dietary method of determining allergens is much preferable.

Course and Prognosis

As mentioned, the skin usually clears before the age of two years. However, these children are likely to suffer, in later

life, from atopic dermatitis, hay fever and asthma.

Atopic Dermatitis

"No physician feels secure in his management of atopic dermatitis". Because of the psychogenic element present and because these persons have become sensitive to so many allergens, it is impractical and impossible to eliminate all those substances to which they test positively. It is, however, of benefit to remove as many recognizable agents as possible. Often a move to a different geographical location is of value, a warm, dry climate being preferable.

Local Treatment

It is imperative not to overtreat locally. All irritants such as fur, wool, and soap must be avoided. Cleansing is done with water alone or mineral oil. Salicylic acid, resorcin, various tars and chrysarobin are examples of mild medications which may be applied to the affected areas. Antipruritics are added to these ointments as needed. Bran baths and local antihistaminics will often bring relief of itching. Restraint by means of arm splints may be indicated. X-rays, judiciously used, will bring temporary relief. Intravenous local anaesthetics may be used as a last resort. In extremis there is alcohol injection of nerve trunks.

General Treatment

The patient must be taught to overcome anxiety. Psychotherapy, autosuggestion and hypnosis have been used with good results. Sedation with phenobarbital will be of aid in accomplishing this.

Antihistaminics will bring relief in half the cases. Ephedrine, atrophine and other sympathomimetics have been advocated to overcome the vasomotor instability which has been blamed as the trigger mechanism. Specific desensitization using inhalant allergens has never been too successful. Non-specific desensitization, using dry thyroid, ultraviolet radiation and many of the others mentioned previously, has been used. All of these may work or may seem to work in individual cases. This may not be due to a specific action but either follow upon the natural course or improve the pyschogenic element of this disease.

Since atopic dermatitis is of the early reaction type, good results should not be expected with ACTH and cortisone, according to the findings of Pickering. However, Cooke, Sulzberger and Freidlander all reported series of cases in which pruritus was relieved and the skin tended to return to normal. Cessation of therapy was followed by a rapid return of symptoms in all instances.

Investigation

Patch tests are of no value, as these people show a normal or less than normal incidence of positive results. This is remarkable considering the irritability of their skins. Scratch, intracutaneous and passive transfer tests only rarely help to identify all the allergens.

Course and Prognosis

This is a chronic recurrent disease of erratic course. Spontaneous remissions may occur at any time. It is rare, however, to find a case which lasts beyond the early thirties. Another point is that the earlier and better the medical treatment the better the prognosis. A small percentage of cases develop cataracts or other ocular abnormalities.

Drug Eruptions (Dermatitis Medicamentosa)

Recognition of the cause and its elimination are the essentials of treatment. When one of several drugs might be the agent, discontinue them all. The wider the assortment of drugs taken by the patient the less chance of a catastrophe occurring on withdrawal. If the action of the drug is essential, then another drug with similar action but different chemical structure can be substituted. If this is not possible, then specific desensitization may be attempted. This procedure, in mild cases, may lead to permanent tolerance, but it is of little practical value and cannot be put into general use.

Since drug eruptions are of many forms the treatment will be directed against the local morbid process as dictated by the morphology of the eruption. Detailed study of these measures is beyond the scope of this paper.

The systemic treatment applied is concerned with speeding excretion of the drug, general detoxification and stimulating or supportive treatment. For example—

Iodide and bromide eruptions are treated with large amounts of sodium chloride which replaces the other halogens in the tissues.

Arsenical eruptions and other dermatoses due to heavy metals are treated with British Anti Lewisite.

Vitamin K, cardiac and vascular stimulants, desoxycorticosterone, Vitamin B and liver extracts are employed as dictated by the individual instance.

ACTH and cortisone will speed recovery greatly.

Investigation

Four things are necessary to incriminate a drug—

(1) The eruption must be recognized as possibly being caused by a drug.
(2) A history of exposure must be elicited.
(3) Improvement must follow upon discontinuance of the drug.
(4) Recurrence of exacerbation on re-exposure to the drug. This latter is usually neither recommended nor needed.

Skin tests are of little or no value, except in eczematous conditions when patch tests may be helpful.

Demonstration of the drug in the body fluids does little more than establish exposure.

Skin Tests

These have been designed to test the skin's capacity to react. When properly executed they will show if this capacity has been altered in any way.

Cases for skin testing must be carefully selected after consideration of all available data. There is no point in carrying out skin tests when a substance is definitely implicated unless scientific studies, medical teaching or legal questions are involved.

Skin tests are not the sole diagnostic method and they must be interpreted in the light of other findings. Positive reactions indicate only that the person has been exposed to the agent and has become sensitized to it. Negative reactions do not exonerate a substance clinically. False negative and positive reactions are common. Some of the reasons for this are as follows—

(1) The conditions of testing may differ radically from those of clinical exposure.
(2) Different sites will react differently at different times.

(3) The antigens used for testing may differ from those encountered clinically.

As a general rule the closer the test is applied to the actual dermatitis the greater the likelihood of producing a positive result. Also, the resemblance between the skin test and the clinical picture is strongly suggestive that they are caused by the same antigen. (However, to repudiate this there is the Koebner phenomenon in which any non-specific irritant or allergen may, on occasion, produce reactions which resemble exactly the clinical lesions.)

Patch Test

This tests epidermal sensitivity. The method may be found in any standard text in Dermatology and a comprehensive list of the concentrations and vehicles to be used for various substances may be found in the Year Book of Dermatology and Syphilology 1943.

A number of rules must be observed in patch testing—

(1) Patients should not be tested during the acute stage of the disease, especially when there are widespread lesions.
(2) A substance should not be tested unless its action on normal skin is known.
(3) Tests should not be done in places where severe reactions would be disfiguring.
(4) Any test that is causing discomfort should be removed.

The tests are read at 48 hours and, if possible, at 96 hours, 1 week and 2 weeks. The response is eczematous in type. Reactions of already present hypersensitivity appear in two to four days. Reactions that appear after 6 or more days indicate newly developed sensitivity.

The Uses of the Patch Test—

(1) To help find eliciting agents in cases of acute and subacute, recurrent contact dermatitis.
(2) To help select those topical medicaments to which the patient is not hypersensitive.
(3) To assist in the differential diagnosis between contact dermatitis and other dermatidites.
(4) To assist in discovering the causes of occupational dermatoses and to trace allergenic hazards in industry.
(5) To investigate goods intended for consumer use as to their possible harmful effects.
(6) To select workers for employment in occupations entailing exposure to notorious sensitizing agents.

With the patch test, 30 to 50% of all suitable selected cases will be clarified as to cause.

Untoward reactions may occur—

(a) *Local*
   1. Burns due to primary irritants not suitably diluted.
   2. Production of local cutaneous hypersensitivity.

(b) *General*
   1. Systemic poisoning due to absorption of such things as lead and phenol.
   2. Generalized dermatitis due to absorption of the testing material.

Scratch and Intracutaneous Tests

In both of these the testing material is introduced beneath the superficial layers of the dermis and thus they test

dermal sensitivity. The scratch test seems to be the method of choice as constitutional reactions are less common, infections are rarer, and it is simple and inexpensive. The sensitivity is about equal in the two types—the intracutaneous type having the slight edge. These tests are used to elicit agents which might be causing atopic dermatitis, infantile eczema, urticaria and other diseases, such as asthma and hay fever.

Passive Transfer Test

The passive transfer antibody found in blood plasma is used to sensitize the skin of a non-allergic person to an allergen, the Prausnitz-Kutsner reaction. Its greatest value is in testing allergic diseases such as infantile eczema, when the lesions are so widespread that there is no normal skin available for testing. The response to this test and also the scratch and intracutaneous tests is a rapidly appearing and a rapidly disappearing wheal.

Acknowledgement

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Whatever the difficulties may be of deciding whether a patient is psychotic or only psychoneurotic, it is nothing to the difficulty of knowing into which of the traditional psychoneurotic categories we should place him.

JOHN BOWLBY

CEREBRAL ANGIOGRAPHY*

H. FIELDS, 5T3

Cerebral angiography is the method of radiological visualization of the cerebral vessels while the latter are being perfused with a radio-opaque material. It has been well established that with reasonable precautions this procedure is a safe and useful method for the diagnosis and localization of intracranial lesions.

A knowledge of the normal anatomy of the cerebral vessels is essential for the interpretation of angiograms. Since this information is not readily available in standard anatomy texts, the main features of the normal vascular pattern will be outlined briefly.

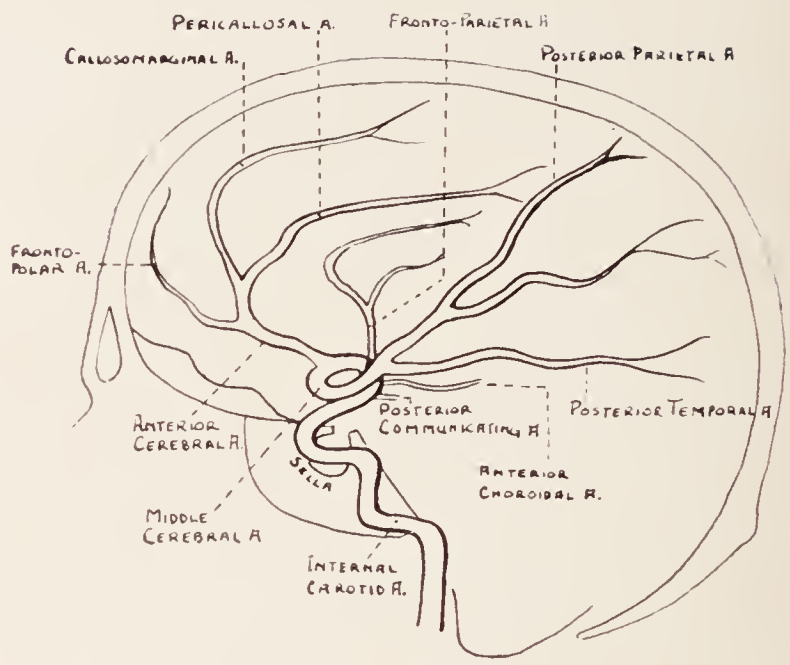

Plate I
Normal Frontal Carotid Arteriogram

The Normal Carotid Arteriogram (See Plates I and II)

Each internal carotid artery supplies the ipsilateral half of the supratentorial part of the brain with the exception, usually, of the occipital lobe which is supplied by the posterior cerebral artery. The internal carotid artery passes through the skull in the carotid canal, and in this canal the vessel makes two almost right-angled bends. The first bend occurs immediately above the entrance to the canal and then the artery proceeds antero-medially in a horizontal plane for about 1.5 cm. prior to executing the second bend. It then courses cranially for another 1.5 cm. before perforating the external layer of the dura to enter the cavernous sinus. Here the artery bends once again to course anteriorly along the lateral wall of the sella turcica. It leaves the cavernous sinus just medial to the anterior clinoid process, and simultaneously completes an "S-shaped" curve before bifurcating into its two principal branches, the middle and anterior cere-

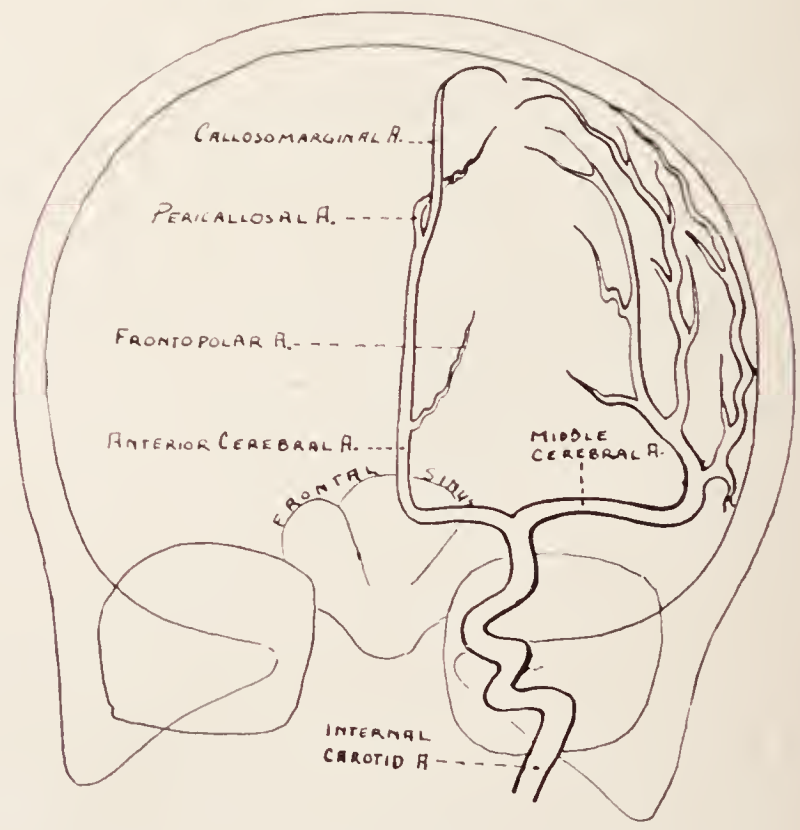

Plate II
Normal Lateral Carotid Arteriogram

*From a paper delivered to the A.O.A. Society.

bral arteries. The middle cerebral artery courses directly laterally to attain the Sylvian fissure when it divides into three main branches, known collectively as the Sylvian group. The anterior cerebral artery passes antero-medially in a horizontal plane to reach the median cerebral fissure where it executes a sharp upward curve; from this point onward, the artery and its principal branches (fronto-polar, marginal callosal, and pericallosal arteries) remain almost strictly in a vertical plane. The ophthalmic artery is not constantly seen on diodrast arteriograms and the first branch of the carotid tree to make its appearance is the posterior communicating artery; slightly above it is the anterior choroidal artery.

The Normal Venogram
(See Plate III)

The cerebral veins are divisible into two groups, the superficial cerebral veins on the lateral surfaces of the cerebrum and the deep cerebral veins near the medial surfaces. The superficial cerebral veins are inconstant in position and are relatively unimportant. The two most commonly seen are the vein of Trollard which drains into the superior saggital sinus and the vein of Labbé which drains posteriorly into the transverse sinus. The deep cerebral veins are more constant in position and three are most commonly seen. The internal cerebral veins course posteriorly from the foramina of Munroe to a point above the pineal gland to drain into the vein of Galen. The latter executes a characteristic curve around the splenium of the corpus callosum before emptying into the straight sinus. The vein of Rosenthal joins the vein of Galen at its most dependent part.

The vertebral arterial system will not be described because, with the exception of the superior cerebellar pair, the infratentorial arteries are of small calibre and are not constantly seen on the arteriograms. Furthermore, the dense petrous temporal bones overshadow much of the arterial tree. These anatomical facts tend to limit vertebral angiography largely to the demonstration of very gross vascular lesions. Space occupying lesions in the posterior fossa are best demonstrated by air studies.

Indications for Cerebral Angiography

The various lesions which may be demonstrated by angiography are itemized in the following table, and for reasons given the table refers largely to the uses of carotid angiography.

I. Intracranial Haemorrhage:
  1. spontaneous subarachnoid haemorrhage:
    (a) Congenital Aneurysms.
    (b) Bleeding Angiomas.
  2. sequellae of head injury:
    (a) Acute
      —Epidural Haematoma
      —Subdural Haematoma
      —Intracerebral Haematoma
    (b) Chronic
      —Chronic Subdural Haematoma
      —Arterio-Venous Fistula.

II. Tumours and Lesions Simulating Tumours:
  1. Arterial Occlusion
  2. Arteriosclerotic Aneurysm
  3. Angiomas
  4. Expanding Lesions—*Avascular*
    (a) One of (5) below—Atypical
    (b) Benign Gliomata
    (c) Abscess
    (d) Granulomata
  5. Expanding Lesions—*Vascular*
    (a) Meningiomas
    (b) Malignant Gliomas
    (c) Metastases.

These lesions are grouped under the two major clinical indications for cere-

bral angiography. The first of these is suspected intracranial haemorrhage, and this may be of two types (1) spontaneous subarachnoid haemorrhage and (2) that resulting from head injury. The second clinical indication for the procedure is the suspicion of an intracranial tumour or a lesion simulating a tumour. There are two main groups of conditions which may give rise to this suspicion—the first of these are vascular lesions (arterial occlusion, arteriosclerotic aneurysms, and blood vessel tumours) and the second category comprises all other space occupying lesions. The latter are subdivided into two classes—vascular and avascular—dependent upon whether or not the lesion possesses a circulatory system peculiar to itself. Each of these tabulated lesions will be discussed very briefly in terms of pertinent pathology, and the status of angiography in the diagnosis of the condition.

I. *Intracranial Haemorrhage*

1. SPONTANEOUS SUBARACHNOID HAEMORRHAGE:

The commonest cause of spontaneous subarachnoid haemorrhage is the rupture of a congenital saccular aneurism, but occasionally bleeding angiomas or arterio-venous malformations may be the responsible lesion. The congenital saccular lesions, which not infrequently are mutliple, are subarachnoid in position and arise from the intradural portion of the internal carotid artery, or from the circle of Willis or its branches. The reported anatomical distribution of these lesions in Dandy's series was 44% on the carotid artery, 19% on the anterior cerebral artery, 18% on the basilar artery. The angiomata and arterio-venous malformations will be mentioned later under blood vessel tumours. Subarachnoid haemorrhage is at present *the* clear-cut indication for cerebral angiography, for this procedure will establish the diagnosis in the great majority of instances. The question as to *when* the procedure should be carried out on a patient with a recent subarachnoid haemorrhage is still controversial. The majority opinion at the present time appears to be in favour of immediate angiography, but some of the dissenters from this view recommend intervals of as long as 6 to 8 weeks following such an accident.

2 (a) ACUTE HAEMORRHAGE RESULTING FROM HEAD INJURY:

Cerebral angiography has been little used on this continent in the investigation of the acute haemorrhage which occurs in certain head injuries, but recently Webster *et al* in Detroit published a report on the use of the procedure in a series of 30 gravely ill patients who were suspected of having massive intracranial haemorrhage resulting from head injury. On the basis of their experience they conclude that cerebral angiography can be a useful method in these circumstances. They state that a successful angiogram may accurately locate a massive lesion and may also differentiate between acute epidural, subdural, and intracerebral haematomas. They emphasize that the procedure is of special value where extra and intra-cerebral haematomas co-exist, the inference being that otherwise the intra-cerebral lesion might be overlooked. Further, they believe that the procedure is superior to "the more complicated and possibly inaccurate exploratory craniotomies". Most neurosurgeons do not accept these views and they believe that suspected acute intracranial haemorrhage is an indication for early surgical exploration.

(b) CHRONIC SEQUELLAE OF HEAD INJURY:

Chronic subdural haematomas give a very characteristic appearance in a frontal arteriogram, but few cases are candidates for angiography as the history is frequently typical and the surgeon usually establishes the diagnosis with a burr hole. If, however, cerebral angiography is used in this condition, a frontal arteriogram is essential for the diagnosis, and in this view, the cerebral vessels are seen to be pressed inwards from the inner table of the skull by the surface clot.

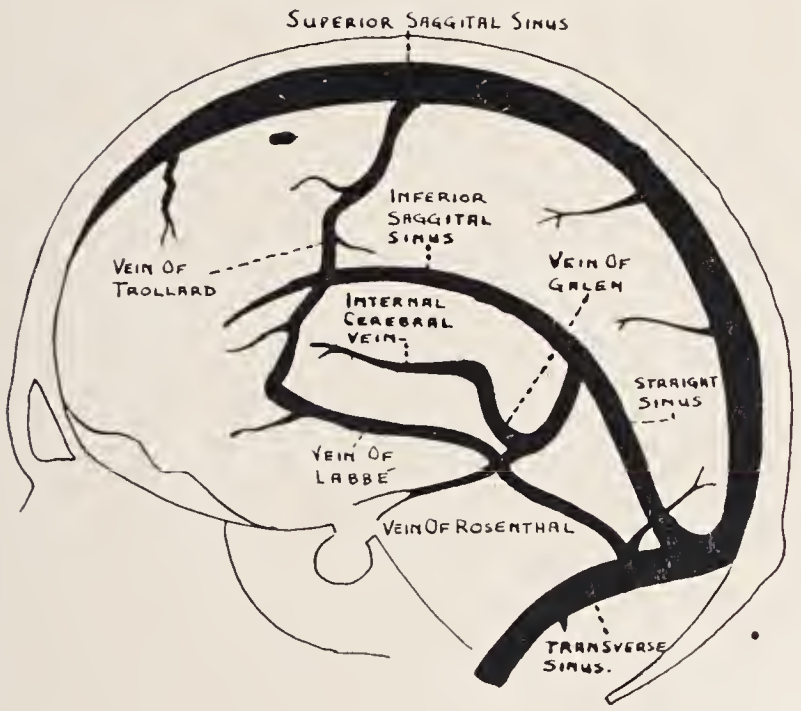

PLATE III
Normal Venogram

The definition of intracranial haemorrhage has been stretched slightly in order to include arterio-venous fistula under this heading. This condition as a rule results from basilar fractures of the skull, but Dandy reports that 25% of his cases were spontaneous in origin. The basic lesion here is a fistulous communication between the internal carotid artery and the cavernous sinus, so that in effect the internal carotid artery haemorrhages into the cavernous sinus. The blood then passes from the cavernous sinus to the internal jugular vein via any of six possible venous pathways. Clinically the presence of a head bruit and pulsating exophthalmus is pathognomonic for this condition; while not indispensable for the diagnosis, angiography gives valuable information regarding channels of altered circulation and thereby aids the plan of surgical attack.

II. *Tumours and Lesions Simulating Tumours*

The following lesions may give rise to the suspicion that a patient has an intracranial tumour or a lesion simulating a tumour.

1. ARTERIAL OCCLUSION:

The clinical differentiation between arterial occlusion and a neoplastic process giving rise to a focal lesion of the cerebrum may at times be very difficult. In cases such as this cerebral angiography frequently affords a specific type diagnosis. It should, however, be emphasized that repeated arteriograms showing lack of contrast filling at the same level are necessary for the diagnosis of arterial occlusion especially when dealing with the smaller cerebral vessels.

2. ARTERIOSCLEROTIC ANEURYSMS:

Arteriosclerotic aneurysms are not common lesions and they form less than 20% of most reported series of aneurysms. They are infra-clinoid and extra-dural in position and arise usually from that portion of the internal carotid artery within the cavernous sinus. They behave as slow growing tumours and frequently become very large, but rarely rupture. The importance of cerebral angiography in the detection of intracranial aneurysms cannot be overemphasized for in this field it is without

parallel as a diagnostic method. Cerebral angiography is indicated in any patient suspected of having a tumour in the region of the sella turcica. It should be noted, however, that occasionally angiography may fail to demonstrate an aneurysm which is clinically evident, possibly because of thrombosis within the aneurysmal sac.

3. BLOOD VESSEL TUMOURS:

Blood vessel tumours are less common than aneurysms and form about 2% of all intracranial tumours. They may be classified as arterial, capillary and venous angiomas and anterio-venous malformations. With the exception of the capillary angiomas all these entities are well demonstrated by angiography.

As mentioned earlier all of the remaining intracranial space occupying lesions are divisible into two groups—vascular and avascular — dependant upon whether or not contrast filled vessels are seen within the lesion itself.

4. AVASCULAR LESIONS:

The main members of the avascular group are the benign gliomata, i.e. astrocytoma and oligodendroglioma, abscesses, granulomata, and occasionally an atypical member of the group that is normally vascularized. These avascular lesions manifest themselves angiographically only by displacing the cerebral vessels from their normal position.

In cases which show gross vascular displacement, the diagnosis and localization of the lesion is relatively simple; however, minimal changes in the position of the cerebral vessels may be very difficult to interpret because of the wide range of permissible variation in the normal vascular pattern. This difficulty has led some radiologists to abandon angiography completely, in favour of air studies, in the investigation of intracranial space occupying lesions. However, in 1948, Wickbomm, a Swedish radiologist with wide experience in this field, published an interesting monograph in which he attempted to assess the relative merits of localization of intracranial tumours by angiographic vascular displacement as compared to localization by air studies. He analyzed a series of 367 tumour cases in which both angiography and air studies had been carried out. His findings are summarized in the following table:

Site	*No. of Cases*	*Angiography* No. +ve	% −ve	*Air Studies* % −ve
TEMPORAL				
1. Sylvian Fissure	7	7	0	0
2. Anterior	86	83	4	10
3. Posterior	21	20	5	0
OCCIPITAL:	14	13	8	15
PARIETAL:				
1. Post-Inferior	24	24	0	10
2. Para-Saggital	18	16	10	25
3. Ant-Superior	10	35	13	15
FRONTAL:				
1. Subfrontal	8	8	0	0
2. Low Lateral	41	35	15	30
3. Convexity	33	23	30	20
4. Deep	20	12	40	0
5. Para-Saggital	24	13	50	15
SELLAR:	9	5	45	10
CENTRAL:	22	0	100	0

It can be seen from the data above that those tumours near the main branches of the carotid arterial tree (i.e. the superficial lesions) are well localized by angiography, and those near the ventricular system are better localized by air studies.

5. VASCULAR LESIONS:

In certain cases, air studies may not be as valuable as angiography, no matter what the location of the tumour. Thus

if tumour vessels are present within the lesion, one may be able not only to diagnose and to localize the tumour, but in addition it may be possible to obtain an histopathological interpretation of the lesion. This is possible because different types of vascular tumours have different and characteristic vascular patterns. The following tumours most frequently show a pathological vascularity:

(a) MENINGIOMAS:

Meningiomas derive their blood supply from both the internal and external carotid arteries and they are frequently rich in vessels. Many of these tumours fill with contrast substance in the arterial phase and often there is a lag period before the tumour vessels empty so that a very characteristic "blush" is seen on the venogram.

(b) GLIOBLASTOMA MULTIFORME:

Glioblastoma multiforme are highly malignant, rapidly growing and infiltrating tumours. A large proportion of these are very vascular and not infrequently one sees small abnormal vessels having a characteristic irregular pattern suggestive of minute arterio-venous aneurysms. When this characteristic pattern is seen it may be very helpful to the surgeon as these lesions are usually inoperable.

(c) TUMOUR METASTASES:

These show a pathological circulation similar to that of the malignant gliomas but the periphery of the tumour is usually better outlined than that of the glioma. If multiple tumours are seen on angiography, the diagnosis is virtually certain as multiple meningiomas or gliomas must be very uncommon.

SUMMARY:

In summary then, cerebral angiography surpasses all other methods in the investigation of intracranial vascular lesions. The role of this procedure in the diagnosis and localization of intracranial space-occupying lesions is controversial. At present it is generally regarded as a useful adjunct to pneumographic methods in selected cases.

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THE CLASS OF 5T3

W. J. KOKENY, 5T5

INTRODUCTORY:

FOR the seventh consecutive year the Medical Journal is endeavouring to gauge the nature, views, and plans of the graduating class. There were 101 or 59% of the questionnaires returned as compared to 60% last year. This year we are reverting to an earlier custom by tabulating the results in detail as they were asked, with the hope that this form of representation may prove to be more interesting, enlightening, and useful.

In many ways the class of 5T3 is not unlike the classes of the past three years, with perhaps one notable exception. Despite the fact that the average age is 26, 46% of the graduates expect to enter one of the specialties whereas among the class of 5T1 where the average age was 24 only 29% expressed such an intention. As expected, the percentage of ex-service personnel is much reduced this year (26%) as compared to 63% last year and 81% in 5T0. At the same time it might be noted that in 5T1 the figure was only 22% due, of course, to the fact that the classes of 5T0 and 5T1 entered the faculty together in the Autumn of 1945. Peacetime levels will undoubtedly be approximated with the classes of 5T5 and 5T6.

In the subsequent summary it follows that, due to the nature of the questions, the accuracy of the figures will vary, it being much easier to tabulate ages and birthplaces than opinions and suggestions. In some places the percentages had to be omitted, and are replaced by the most common recommendations or comments in descending order of frequency. Following some of the questions the most typical or average answer appears in brackets.

I. VITAL STATISTICS

1. Age on graduation? (26)

Age	5T3 %		5T2 %		5T1 %		5T0 %	
21	—		—		—		—	
22	1		1		1		2	
23	16		9		25		6	
24	33		12		41		17	
25	16		12		11		18	
26	8		11		4		19	
27	8		15		8		12	
28	4		11		3		15	
29	2	26	5	55	2	18	9	46
30 and over	12		24		5		10	
Average	26		27		24		26	

2. Sex? (Male) Are you married?(No)

	5T3	5T2	5T1	5T0
Total		175	173	158
Male	94%	96%	82%	95%
Female	6%	4%	18%	5%
Married	33%	42%	19%	39%

If married, have you any children?
20 have no children
4 have 1 child
3 have 2 children
3 have 3 children

Are either of your parents, or any of your brothers or sisters, doctors? (No—83%)

3. Country of birth? (Canada)

Canada	90%	Bolivia	1%
U.S.A.	3%	B.W.I.	2%
Scotland	2%	Czechoslovakia	2%

If Canada, what province?

Ontario	79%	Man.	5%
B.C.	7%	Alberta	3%
Sask.	5%	Quebec	1%

Do you come from a rural or urban community? (Urban—86%)

4. What are your favourite hobbies and recreational activities?

(Answers based on 300% due to multiple choice)

Sports	116%		Dancing	44%	
Reading	49%		Movies	8%	60%
Music	44%	120 %	Cards	8%	
Painting	8%		Others	2%	
Photo'y	19%		No hobbies	2%	

5. Have you professional or technical training in any other fields than medicine? (No—62%)

62% None	2% Photography
9% Scientific	2% Bookbinding
4% Campcraft	2% Secretarial
4% Farming	5% Music
2% Flying	2% Radio
6% 4 others	

II. Accommodation and Finances

1. In Toronto did you live with friends, at home, in a boarding house, fraternity, or elsewhere?

At home	54%	Friends	3%
Boarding	22%	Residence	4%
Fraternity	17%		

Did you have good studying facilities? (Yes)
Good 76% Fair 20% Poor 4%

2. Did you work in the summers? (Yes) Yes—100%
Were you paid? (Yes) Yes—100%
What were your average earnings? $700
(Values ranged from $200 to $1700)
How many summers did you work in a hospital? (One) In a laboratory? (None)

Hospital		Laboratory	
0 summer	47%	0 summer	71%
1 summer	39%	1 summer	19%
2 summers	7%	2 summers	6%
3 summers	6%	3 summers	1%
4 summers	1%	4 summers	1%
		5 summers	2%

Did you ever work during the Christmas holidays? (Yes—72%) Part-time during the medical terms? (No—68%)

3. Did you earn enough from all sources (including DVA, scholarships, savings) to meet your medical education expenses? (No—78%)
If not, how much financial help did you require over the six years? ($3100). Was this borrowed in the sense that it must be paid back? (No—71%)

III. University Life

1. Did you participate in interfaculty Athletics? (Yes—53%)
If so, name them (Total 100%)

Basketball	28%	Hockey	12%
Football	19%	Waterpolo	9%
Volleyball	16%	8 others	16%

Did you participate in intercollegiate Athletics? (No—94%)
Did you participate in unorganized Athletics? (No—52%)
If so, which ones? (swimming, basketball, squash)
Do you think that intercollegiate sport as at present organized is a good thing? (Yes—66%)
Suggestions: (4 most frequent)
Overemphasized
Too much prestige sought
Universities are too "victory conscious"
Should be no travelling during the week
Promote intercollegiate rowing

2. Is Daffydil a worthwhile enterprise? (Yes—99%)
Did you ever take part in it? (No—59%)
If you never took part, did you ever see it?
Yes—57%
No — 2%
} 59% who did not take part
Did you ever attend the Meds-at-Home? (Yes—85%)
Suggestions:
Entertainment is poor, cannot be heard, and should be eliminated.
Hold the dance earlier in the year and move the date to the weekend.
Do not sell corsages.
Arrange cocktail parties before the dance.
What faculty or interfaculty activities did you find most valuable or most enjoyable? (200%)

52%	Meds athletics	8%	Staff nights
48%	Daffydil	7%	Hart House
17%	Meds-at-Home	6%	Debates
15%	Class functions	6%	Osler Society
12%	Medical Journal	29%	13 others

Any sugggestions to increase student participation in faculty activities?
More publicity to encourage enthusiasm.
More organized administration by the Medical Society.
Encourage more premedical participation by stressing value of competition.
Less emphasis on academic standards.

3. Should you have had more opportunities to become better acquainted with your own class and with members of the other medical years?
Yes—63% No—32% Doubtful—5%
In such a large faculty, suggestions for closer student-staff relations.
Student-staff informal evenings.
Decrease size of clinic groups.
Staff is too "high-hatted".
Apprentice every 3rd and 4th year student to a man on the staff.
If possible, arrange informal gatherings with the Dean.
Would a Medical Common Room with facilities for eating lunch and lounging help solve such problems?
Yes—68% No—20% Doubtful—7%
No answer—5%

4. Are college fraternities on the whole a good thing?

Yes 55%	Uncertain—14%
No 17%	No answer—14%

Did you ever join one?
No—56% Yes—44%
If yes, would you advise a younger student to join one?.
Yes—35% No—6% Uncertain—3%

Would you advise a professional or non-professional fraternity?

Professional	23%
Non-professional	12%
Uncertain	9%

Which was yours?

Professional	31%
Non-professional	13%

5. Are you interested in politics?

Yes — 76% No 21% No answer 3%

Do you feel that a presentation of the claims of the political parties would have been valuable as part of your training?

No 57% Yes 40% No answer 3%

6. What is your final aim as you enter upon professional life?

To be a good G.P.
Happiness through professional service and family life.
One of the specialties.
Financial security and prestige.
Improvement through community service.

In what way have your impressions of the medical profession been altered after four years of training and associations?

Now see the profession in a more realistic light.
More respect for most members of the profession and less for others.
Doctors are fallible.
Impressions generally unaltered.

What effect did the course have on your general values?

Very little.
Increased sense of values.
Broadened and clarified values.
Matured and hardened them.
Greater appreciation for the individual.

Should there be more lectures regarding the problems arising in medical ethics? (Yes—81%)

If so, who should give these lectures?

Non-hospital G.P.'s.
Representative clergy and lawyers.
Medico-legal men.
Should be discussed in conjunction with course as it is taken up.
Qualified staff men.

7. Have you suggestions or strong feelings about

The Medical Society

59% No comment	4% Good election campaigns
16% Functions favourably	3% Deserves more support
6% More contact with students	8% Others
4% Hyperorganized	

The Varsity

34% No comment	7% Too much advertising
17% Much improved this year	7% Unfavourable comments
11% Should try faculty issues	14% Others
10% Mixed opinion about sports controversy	

U. of T. Medical Journal

76% Favourable	5% Deserves more support
6% More issues on single topics	2% Unfavourable
5% More student articles	6% No comment

Camsi

38% Other than IPS and movies what does it do?	12% Poorly organized
	9% Improving
	6% Insufficient publicity
21% Should strive for more remunerative internship	14% 13 others

(a) Value for your dollar	(b) CAMSI Journal
51% Favourable	59% Unfavourable
26% No comment	23% No comment
23% Unfavourable	18% Favourable

Hart House

36% Excellent	4% Wonderful but no time for it
21% No comment	4% Efficiently operated
11% Out of way for clinical years	3% Longer hours for tuck shop
6% Why not co-ed?	15% 12 others

Medical Reading Room

22% No comment	5% More co-operative staff
20% Good	4% Too far away
14% Small and uncomfortable	3% Open shelves to students
6% Too cold	20% 17 others
6% Too noisy	

This Questionnaire

35% Favourable	6% Can help to improve curriculum
23% No comment	4% Insufficient space
7% Fascinating and enlightening	3% Some questions ambiguous
6% Anxious to see report	10% 8 others
6% Might give staff a few thoughts	

Any other questions you would like to have asked? (5 most common).

If you reacted unfavourably toward some courses, why?

Room for suggestions regarding individual subjects.

What type of internship do you desire and where do you expect to obtain it?

Do you feel that some subjects are receiving too much attention and others not enough?

What can be done about the internes' low salaries?

IV. The Medical Course

1. Which of the six years did you find the heaviest? Lightest? List two in each case.

Heaviest		Lightest	
I & III Medical	60%	I & II Pre-med	32%
III & IV Medical	14%	II & IV Med.	19%
I & II Medical	11%	I Pre-med & II	
II & III Medical	8%		

Others 7%

Med. 18%
I Pre-med & IV Med. 8%
II Pre-med & IV Med. 7%
III & IV Med. 7%
Others 9%

Which of the six years did you find (a) most interesting and (b) most profitable and informative?

Interesting		Profitable and Informative	
IV Medical	63%	III Medical	62%
III Medical	31%	IV Medical	38%
Others	6%		

Do you feel the course included too much formal academic teaching, and did not allow sufficient time for assimilating the knowledge acquired and for creative thinking on your own part?

Yes 52% No 48%

Suggestions (4 most frequent)

More supervised informal discussion groups of clinic size.
Less discourse and more practical demonstrations.
More time in clinics.
More responsibilities in clinics.

2. What three clinical subjects did you enjoy most? Which three seemed best taught?

Enjoyed	Taught
32% Medicine	35% Medicine
20% Obstetrics	28% Paediatrics
19% Paediatrics	19% Obstetrics
16% Surgery	6% Dermatology
13% Others	12% Others

Which two basic subjects did you enjoy most? Which two seemed best taught?

Enjoyed	Taught
43% Anatomy	60% Anatomy & Neuroanatomy
41% Pathology	
14% Physiology	34% Pathology
2% Others	6% Others

What clinic or laboratory class did you think was best organized?

40% Anatomy	6% Dermatology
27% Pathology	10% Others
17% Obstetrics	

Did you react unfavourably to the way any subjects were taught or the practical work organized?

51% Surgery	13% Others
12% Physiology	12% No comment
12% Hygiene	

3. If you took it at Toronto, have you any comments on the pre-medical course?

40% Unfavourable	23% No comment
37% Favourable	

4. If you had it to do over again, would you enter medicine?

Yes 95% No 2% Undecided 3%

If not, why?

Course too long and difficult.
Face too much hopeless misery and sickness.

If yes, would you enter U. of T.?

Yes 89%

If not, why?

Faculty too large and impersonal.
Don't like Toronto.

5. Did you have any previous University training before entering the Medical course?

No 71%

If so, how many years (3.2 years).

If you proceeded to a degree what was it?

B.A.	18%	B.A.Sc.	2%
M.A.	2%	No degree	7%

Other universities attended, if any?

4% U.B.C.	2% McMaster
4% U. of Sask.	3% American
2% McGill	3% European

The other 11% with previous university training attended U. of T.

On the whole did you like U. of T. better?

No 10% Yes 8%

If not, why?

U. of T. too large.
Difficult to know staff.

V. Future Plans

1. What branch of medicine do you plan to enter?

	5T3 %	5T2 %	5T1 %	5T0 %
Undecided	9	7	8	16
G.P.	45	74	61	56
Specialty	46	19	29	28
Paediatrics	8	—	—	—
Surgery	8	3	10	8
Medicine	5	7	4	2
Obstetrics	4	6	4	1
Psychiatry	2	2	3	1
Unstated Specialty	16	—	—	—
Other specialities	3	—	6	15

Do you hope to proceed from G.P. into a specialty? Yes 7% No 38%

If so, after how many years? (3 years).

2. How long would you like to interne? How long do you expect to interne?

Like		Expect	
1 year	40%	1 year	66%
2 years	26%	2 years	9%
3 years or more	34%	3 years or more	25%

Do you expect to take this interneship in Canada?

Yes 85%

If not, where?

United States 12% United Kingdom 3%

Would you like to spend some time in post graduate training? Yes 93%

Do you think you will, and if so, how long?

Yes 68% Average 3 yrs.

Do you expect to take this training in Canada?

Yes 36% No 14% Undecided 18%

3. Do you expect to practise in Canada?

Yes 91%

If so, in what province?

75% Ontario	5% Sask.
8% B.C.	2% Manitoba
5% Alberta	5% Undecided

If not, where?

6% U.S.A.	1% Missions
2% B.W.I.	

Will you be practising in a city, a town, or a community of 1000 or less?

City	63%	Community under	
Town	28%	1000	9%

Have you a definite opening or opportunity?

No 79%

Will you be in partnership with an older practitioner? Yes 4%

4. Would you like to practise as part of a group?

Yes	74%	Undecided	10%
No	16%		

If yes, permanently?

Yes	42%	Undecided	13%
No	19%		

How many practitioners would you want in such a group? (based on 100%).

46% Four	12% More than four
42% Two or three	

Would you be a specialist or a G.P. in such a group?

52% G.P.	17% Undecided
31% Specialist	

Would you want such a group to co-operate to the extent of pooling clerical expenses, staff, expensive specialized equipment, office accommodation, etc.?

Yes	91%	Undecided	3%
No	6%		

Do you expect to participate in such a group scheme?

Undecided	39%	Yes	37%
No	24%		

5. Are "Health Insurance plans" (such as the Associated Medical Services) a good thing for the public? For our profession?

Public		Profession	
Yes	94%	Yes	77%
No	3%	No	10%
Undecided	3%	Undecided	13%

Do you expect a substantial degree of socialized medicine in Canada within 10 years?

Yes 62% No 35% Undecided 3%

Is socialized medicine on the whole a good thing for the public? For our profession?

Public		Profession	
Yes	49%	No	68%
No	44%	Undecided	17%
Undecided	7%	Yes	15%

6. If you were to serve with one of the Armed Forces, which would you choose?

Air Force	38%	Navy	20%
Army	33%	Undecided	9%

What are the chances of Canada being involved in a major war within the next 10 years?

Good	47%	Poor	21%
Fair	12%	Uncertain	20%

PHYSICIANS' ART SALON

All Canadian physicians and medical undergraduates with art or photography as a hobby are invited to exhibit some of their work at the 9th annual Physicians' Art Salon, to be held at the Royal Alexandra Hotel, Winnipeg, from June 15 to 19, in conjunction with the Convention. All entries in the division of fine arts, monochrome photography, and colour transparencies will be displayed on the convention floor and judged for awards by a panel of outstanding Canadian artists. Members of this panel are: Mr. J. M. Duncan, Mr. Alvin C. Eastman and Mr. Bert Hunter. By popular request there will be a slight modification in judging of fine art. Entries will be subdivided into traditional and modern works, and prizes awarded in each category.

Again sponsored by Frank W. Horner Limited the salon is expected to attract a large number of enthusiasts in the various media. Organized originally to foster restful pursuits in the profession, the Physicians' Art Salon has aroused widespread interest across the Dominion and has become a forum at which artistically gifted physicians can exhibit the produce of their leisure hours before an interested medical audience.

In addition to awarding prizes the Horner Company will reproduce winners in the 1954 Physicians' Art Salon calendar. A copy of this attractive full colour desk model can be obtained by writing Frank W. Horner Limited.

Anyone interested in entering work is urged to notify the sponsor, P.O. Box 6139, Montreal, who will furnish full details and the necessary entry form. A short note or postcard will do. All expenses, including the transportation of exhibits to and from Winnipeg, will be borne by the sponsor.

Entry forms must be completed and in hand before May 25th to ensure proper listing of exhibits in the catalogue. Exhibitors are also asked to ship entries far enough in advance to allow for the inevitable delays in express and parcel post. Full shipping instructions appear on the entry form.

VITAMIN E

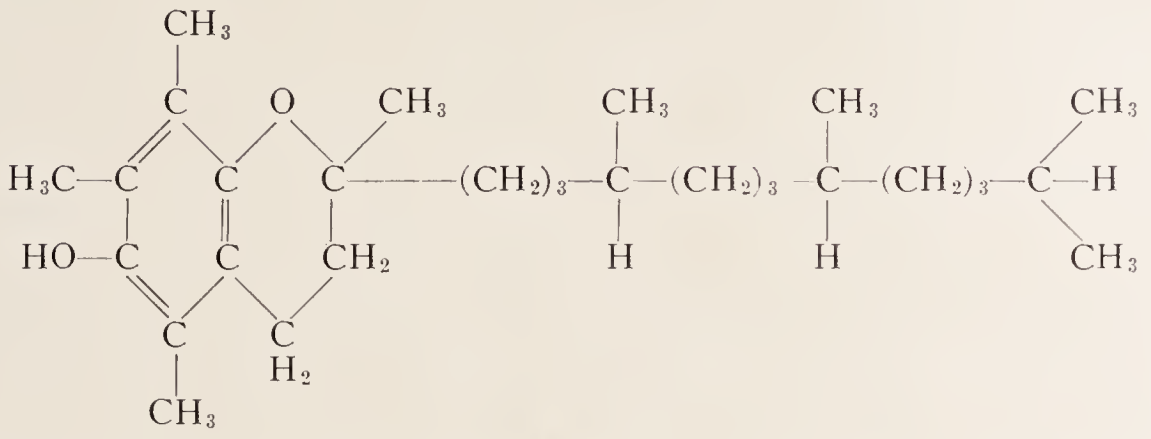
F. E. A. GRIFFITHS, 5T4
R. L. PERKIN, 5T4

Introduction

This paper is a review of the literature on vitamin E in the hope that its place in therapy may be more clearly defined.

I. Biological Actions

Vitamin E is known chemically as α-Tocopherol and is classed as a fat-soluble vitamin.



This is a derivative of chromane.

The word tocopherol comes from the Latin *tokos* (childbirth) and *phero* (I bear). There are three naturally occurring tocopherols α, β and γ, of which only α is active biologically and makes up 50% of those found.

Normally, vitamin E is found in green vegetables and in the germ of many seeds, e.g., wheat germ. Almost any diet short of starvation will supply adequate vitamin E to maintain normal blood levels which are 1 mgm % in males and non-pregnant females, and 1.6 mgms % in pregnant females.

The literature is confusing and in many places contradictory on the actions of this compound. Different investigators have described the following actions resulting from a deficiency of the vitamin:

(a) After four months' deprivation, sperms of the male rat are incapable of fertilizing the ovum, the chromatin in them having undergone lysis.

(b) Atrophy of the seminiferous tubules with the formation of giant cells by the germinal epithelium.

(c) Loss of potency.

(d) In females the process of foetal implantation is poorly accomplished with death of the foetus and abortion. This death is partially due to incomplete implantation, and failure of growth of the haemopoetic tissue in the walls of the yolk sac.

(e) Enlarged basophil cells in the anterior pituitary causing a decrease in lutealizing hormone.

(f) Enlargement of the thymus.

(g) Decrease in the rate of wound healing.

(h) Hypoplasia of the thyroid.

(k) Degenerative lesions in smooth muscle, not unlike those encountered in muscular dystrophy in man.

Vitamin E and vitamin A are interrelated. If one is deficient in vitamin A and vitamin E is withheld, it takes longer to become deficient in vitamin E than

if vitamin A was at normal levels. This may be due to reduced testicular function in vitamin A deficiency which results in decreased vitamin E uptake. Also, vitamin E increases hepatic storage of vitamin A and protects it from oxidation in the gastrointestinal tract.

II. Administration

Almost all drug firms produce a brand of vitamin E, the most popular being in capsules of 30 and 100 mgms. It may also be given intramuscularly in oil. It is usually given orally in a dose of 300 mgms a day for most conditions in which it is used, and 100 mgms daily for hypertension and chronic rheumatic heart disease. The cost of the 300 mgms dose is approximately twenty cents daily.

III. Toxicity and Contraindications

Toxic reactions to alpha-tocopherol are infrequent and usually mild when they do occur. The Shutes have observed the following:

(1) A generalized maculopapular rash.
(2) Nausea with large doses.
(3) Some elevation of previously normal blood pressure.
(4) Rapid pulse rate.

The contraindications to the use of vitamin E are only vaguely defined in the literature. Heavy doses are not recommended in the following conditions:

(1) Pre-eclampsia or eclampsia.
(2) Chronic rheumatic heart disease with incipient failure.
(3) Extreme hypertension.
(4) Hyperthyroidism.
(5) Iron therapy — iron nullifies action of alpha-tocopherol.

In addition, vitamin E is reported to lower the digitalis or insulin requirements in patients already receiving one or both of these drugs. This may occur soon after treatment is started or suddenly after months of vitamin E therapy.

IV. Indications for Use

The indications for vitamin E administration are many according to some observers and none according to others. In attempting to assess the many controversial results, we are continually faced with the more basic controversy of scientific method and controlled experiment. In a 1950 editorial in the Shute Foundation journal *The Summary*, the Shute group defend their failure to use and their lack of respect for control experiments. Their stand is briefly this:

The percentage of truly controlled research reported in the literature is small. The use of "controls" requires a large number of patients with the same disease and similar clinical conditions. The patients in the control group are not receiving benefit from the therapy given those in the trial group.

We feel, on the other hand, that valid assessment of a new therapeutic agent necessitates the use of controlled experiments, especially in the field of treatment where vitamin E is being tested, for the vast majority of the recorded results are of necessity based on subjective observations by the patient of his own symptoms —and this is, indeed, treacherous ground.

For the purposes of this paper, representative results are reported from the literature in an effort to present both sides of the question; no attempt is made to present all the literature on this subject. The use of alpha-tocopherol in the treatment of angina pectoris, rheumatic heart disease, hypertensive heart disease and peripheral vascular disease is dis-

cussed; its other proposed uses are mentioned.

A. ANGINA PECTORIS.

The Shute group report a series of 84 cases in which 7% achieved complete pain relief, 45% marked relief, and 44% moderate relief. They conclude that vitamin E gives great relief promptly in the majority of cases of angina. They also report increased exercise tolerance, decreased pain, and diuresis in angina cases complicated by congestive failure which are treated with vitamin E.

Levy and Boas, on the other hand, report alpha-tocopherol "a singularly inert drug". They found no improvement in 5 cases of chronic angina and only transient improvement in one of three cases of active progressive angina treated with oral vitamin E.

Gram and Schmidt, Norwegian investigators, reported a series of 80 patients with arteriosclerotic heart disease and angina in which vitamin E therapy resulted in no subjective and no objective improvement in 63 cases, some subjective improvements in 12 cases, and objective improvement in 5 cases. A reduction in the nitroglycerin required to relieve pain was taken as a measure of objective improvement.

Makinson, Olesky and Stone conducted an experiment in 1948 in which 22 angina patients were treated for three weeks each on one of the following:

	Better	No Change
Vitamin E	10	12
Phenobarbitone	10	12
Aminophylline	8	14
Calcium lactate (placebo)	4	18

Also in 1948, K. P. Ball reported a series of ten angina cases in which six showed no improvement on vitamin E, one marked improvement, one moderate improvement, and two slight improvements. He points out that as high as 40% of cases will show subjective improvement on convincing therapy using only placebo.

B. CHRONIC RHEUMATIC HEART DISEASE.

Shute reports a group of 28 cases with the following results:

Complete relief of symptoms	0
Marked relief	53%
Moderate relief	43%
No relief	4%

Improvement is attributed to beneficial actions of the vitamin on the myocardium, not to any change in the damaged valves.

Levy and Boas report a series of five cases in which vitamin E was of no benefit.

Many other studies are reported in the literature on this topic, but most of them are either accounts of one or two patients or animal experiments. One is inclined to be wary of animal studies in this field, for it was the anti-sterility action of vitamin E in male rats which first brought it to the fore, yet attempts to verify this action in humans have all been unsuccessful.

C. HYPERTENSIVE HEART DISEASE

Shutes report a series of 66 cases with complete relief of symptoms in no cases, marked relief in 42%, moderate relief in 43%, no relief in 3%, and death in 12%. They do not recommend its use in cases of severe hypertension.

No other large series were found in the literature dealing with hypertension alone.

O'Connor reported in 1951 a series of 100 cases of all types of cardiovascular disease except hypertension and thyro-

toxicosis, all of which responded well to vitamin E. No criteria of improvement are stipulated and no controls are used—two factors common to many published reports on this subject which make results very difficult to assess.

D. PERIPHERAL VASCULAR DISEASE.

The Shutes recommend the use of vitamin E in all types of peripheral vascular disease including Buerger's disease, arteriosclerosis, thrombosis, incipient gangrene, and all types of leg ulcers. The response which they observe they attribute to improved capillary circulation and better oxygen utilization by the tissues.

Boyd, Ratcliffe et al have studied a large number of cases of intermittent claudication at their Manchester clinic. They divide their cases into mild, moderate and severe groups. The mild cases are helped by any therapy. Lumbar ganglionectomy is their treatment of choice in the moderate cases. Alpha-tocopherol in daily doses of 400 mgms orally is their treatment in those cases where ganglionectomy is contraindicated. They specify improvement in these moderate cases as being the ability to walk 880 yards without experiencing calf pain where previously the patient could walk a maximum of only 500 yards without pain. Of 41 cases treated for four months or more on vitamin E, 31 were improved. In a "control" group of 25 patients, only five were improved. It should be noted that the patients in this "control" group previously denied therapy and consequently do not constitute a true control. They conclude that vitamin E therapy is effective, but stipulate that it must be long, intensive, and therefore expensive. In severe cases of intermittent claudication they find Achilles tendontenotomy to be the only effective treatment.

Hamilton and Wilson state that the problem is a difficult one to judge owing to the spontaneous improvement of many cases of intermittent claudication receiving no treatment and to the dependence of the examiner on the patient's observance of pain as the only means of evaluating treatment. They had their patients walk up a pair of steps, each eighteen inches high, and counted the number of circuits before pain occurred. Ten patients receiving no treatment showed considerable fluctuation in exercise tolerance from week to week. One patient on a placebo for several weeks showed progressive improvement. On vitamin E, one in eleven improved. On testosterone, one in ten improved. Patients on one of nicotinic acid, dihydroergotamine, papaverine, or aminophylline did not improve. This latter observation, they conclude, is not surprising since during exercise the vessels are already under the influence of powerful vasodilators—the tissue metabolites.

E. MISCELLANEOUS.

Vitamin E has been used and is being used in the treatment of numerous other conditions including the following:

(1) Thrombocytopenic purpura
(2) Chronic neuromuscular pains
(3) Fibrositis
(4) Dupuytren's contracture
(5) Muscular dystrophy
(6) Amyotrophic lateral sclerosis
(7) Myelopathy in pernicious anemia
(8) Scleroderma
(9) Nephritis and nephrosis
(10) Diabetes mellitus
(11) Menopausal symptoms
(12) Habitual abortion

(13) Toxaemia of pregnancy

To date, the number of reported cases is too few to indicate whether alpha-tocopherol is of any value in their treatment.

V. Conclusions

(1) There is evidence that alpha-tocopherol may be of value in the treatment of some cases of peripheral vascular disease.

(2) The usefulness of vitamin E in the management of heart disease is not proven.

(3) Controlled experimental series using large numbers of cases and criteria of judgment which are as objective as the clinical situation permits are necessary for valid assessment of this or any other therapeutic agent.

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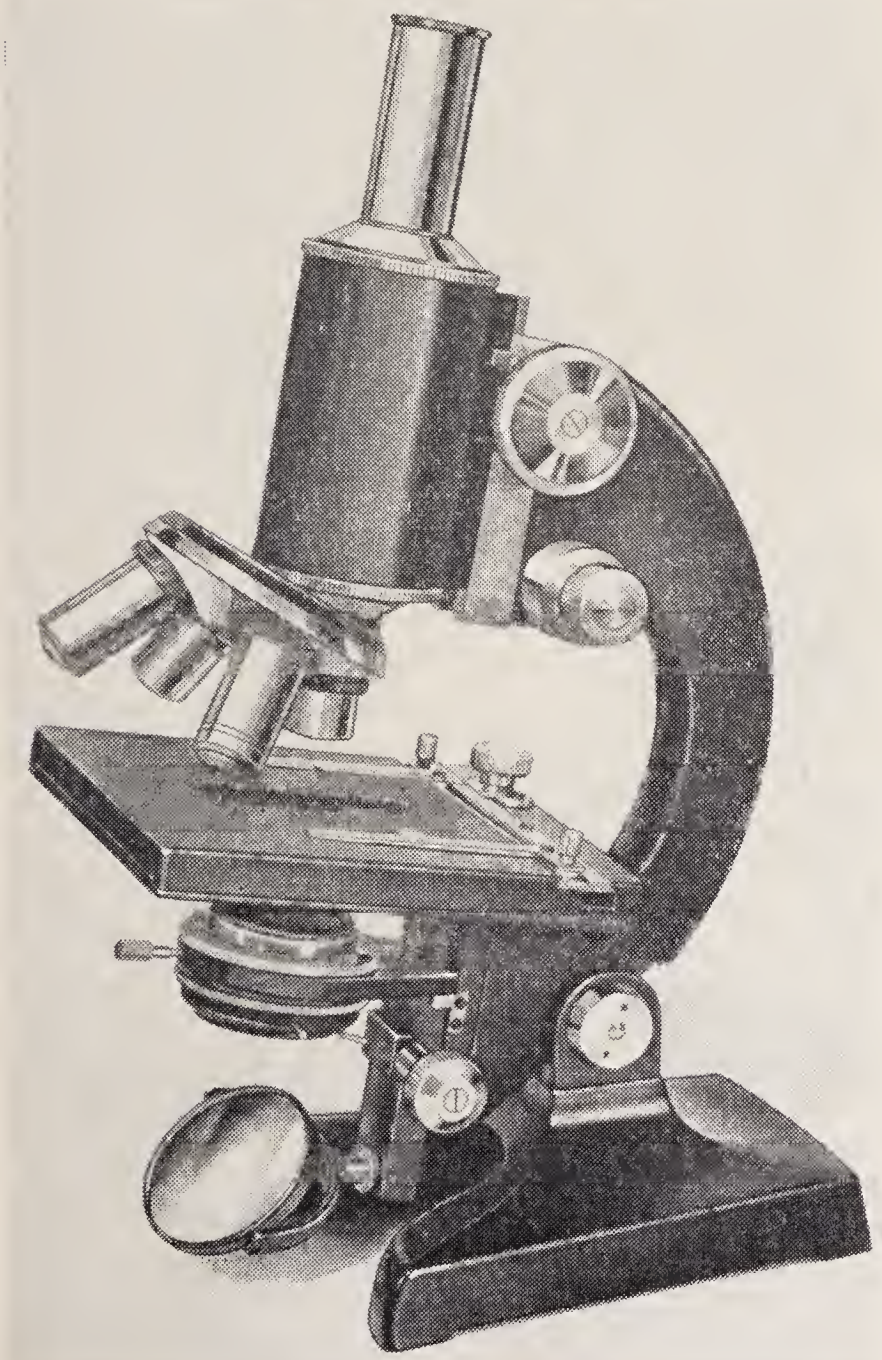

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NEWS AND NOTES

Medical Society

At the Medical Society elections held in Hart House Theatre on March 9, the following candidates were successful: J. B. Stalker, President; J. L. Laudon, Vice-President; D. J. L. Moran, Treasurer and R. F. Martin, Secretary. The newly-elected Class Presidents are R. Van Praagh, 5T4; J. B. Bassingsthwaite, 5T5; J. Bliss, 5T6; W. Cumming, 5T7, and J. A. Wilkinson, 5T8. The Permanent Executive for the graduating class includes W. Rawlinson, President, E. D. Wigle, Vice-President and B. Berman, Secretary-Treasurer.

* * *

The newly-elected officers of the Medical Womens's Undergraduate Association are: Miss B. Russell, President; Miss M. Swanson, Vice-President; Miss M. Stout, Treasurer; Miss M. Cowan, Secretary, and Miss V. Heller, Social Convenor.

* * *

The new Senior and Junior Local CAMSI Officers are T. A. Bayley and A. T. Arai respectively. The new N.F.C.U.S. representative for the Faculty is Miss M. C. Norman.

* * *

68% of the total student body voted in the Society elections. The breakdown into years was as follows: 5T3, 32% voted; 5T4, 83%; 5T5, 76%; 5T6, 70%; 5T7, 80% and 5T8, 75%.

* * *

The Final Year Banquet was held on March 28 at the Prince George Hotel. The guest speaker was Dr. Wilder Penfield, O.M., director of the Montreal Neurological Institute.

* * *

Judging from the enthusiastic response of the many couples present at the Royal York Hotel on the evening of February 18, this year's Meds-At-Home was an entirely successful event. Congratulations are most certainly due to Peter Blundell, Max Irwin, and Doug Salmon and all those who helped them to make the dance possible.

The annual dinner for the graduating class in Medicine will be held at Hart House on June 16th at 7.00 p.m. Tickets may be obtained at the Medical Office.

* * *

Medical Athletics

The new executive of the Medical Athletic Association includes C. P. Vernon, President; C. H. MacDougall, Vice-President, and B. Langer, Secretary-Treasurer.

* * *

The Annual Banquet of the Medical Athletic Association was held on the evening of March 24 at the Diana Sweets Restaurant. The guest speaker was the Honorary President of the Association Dr. W. T. Mustard.

* * *

The Senior Meds Hockey team finished the season in first place in their division of the Interfaculty Hockey League. In the semi-finals for the Jennings Cup, they lost a close 5-3 decision to the Senior School entry. This has been a very successful year for the team and Captain Jim McGillivray and his team-mates are to be congratulated on a fine performance.

* * *

The new officers for the Medical Women's Athletic Association are Miss S. Sarles, President; Miss M. Platts, Vice-President; Miss H. Humphries, Treasurer, and Miss D. Kerr, Secretary.

* * *

Annual banquet of the Medical Women's Athletic Association was held on the evening of March 24 at the Diet Kitchen. The speaker was Dr. Jessie Gray and awards were presented to the following: Junior "T" to Miss B. Russell and Miss J. Cridland: Third

Colours to Miss M. McCurdy; Medical "M" to Miss J. Cridland, Miss S. Kyle, Miss B. McCree, Miss M. Platts and Miss M. Sonley.

C.A.M.S.I.

The outgoing Senior Local C.A.M.S.I. Officer, Dave Smith, reports that 97% of this year's graduating class have been successful in obtaining internships in the hospital they named as their first choice. These results are due to the splendid work of the Canadian Interne Placement Service, a division of C.A.M.S.I.

Faculty

The Charles Mickle Fellowship has been awarded this year to Sir Frank Macfarlane Burnet, M.D., Sc.D., (Hon.), F.R.S., for his work in the field of virus.

* * *

The Medical Alumi Association Bursaries for this year have been granted to A. S. Davidson, Meds 5T6; T. J. C. Bell, Meds 5T5 and J. R. MacDougal, D. J. MacFayden, F. J. Moran and E. K. Ranney, all of Meds 5T3.

* * *

The following graduates of this University have been successful at the recent Fellowship examinations of the Royal College of Physicians and Surgeons of Canada: in the Medical division: R. W. Bell-Irving, A. Bogoch, J. E. C. Cole, J. S. Crawford, P. T. Green, T. E. Hunt, L. F. Koyl, H. W. Lamont-Havers, P. M. O'Sullivan, B. T. Rogers, A. S. Sharp, A. M. Park, A. M.Bryans, K. F. Clute, M. J. O'Brien, and O. B. Millar: in the Surgical division; W. G. Beattie, R. W. Cram, P. O. Crassweller, H. J. Grossman, A. J. Kergin, F. L. Lawson, W. F. Lumsden, W. J. McCracken, A. Raxlen, E. F. Rantley, H. M. Wallis, G. W. Wilkinson, C. W. Gaylro, J. L. M. Bean, F. E. Bryans, W. P. Callahan, J A. Virtue, and A. S. Tauber.

J. W. Goodwin

The best physician is the man who can distinguish between the possible and the impossible.

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The man who confesses his ignorance shows it once; he who tries to conceal it shows it many times.

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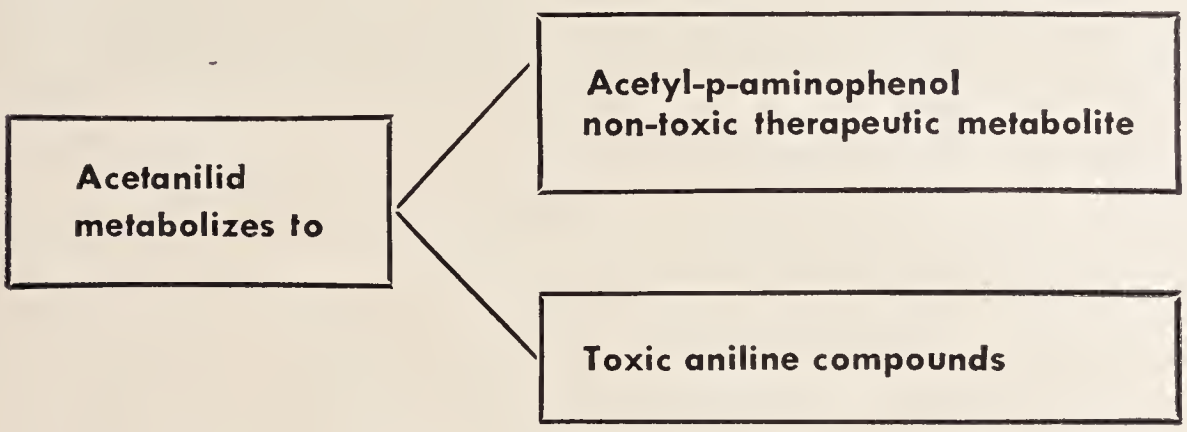

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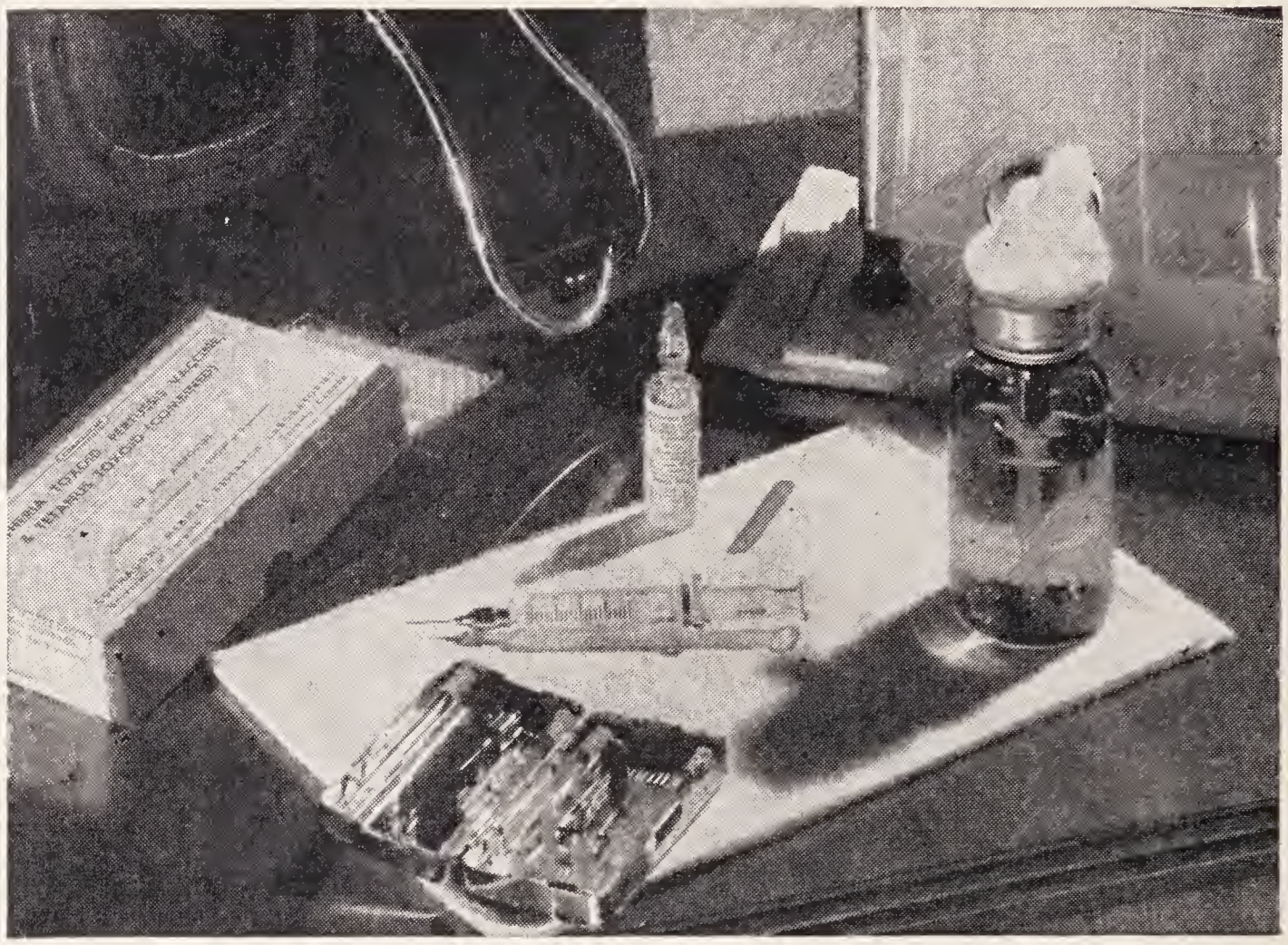

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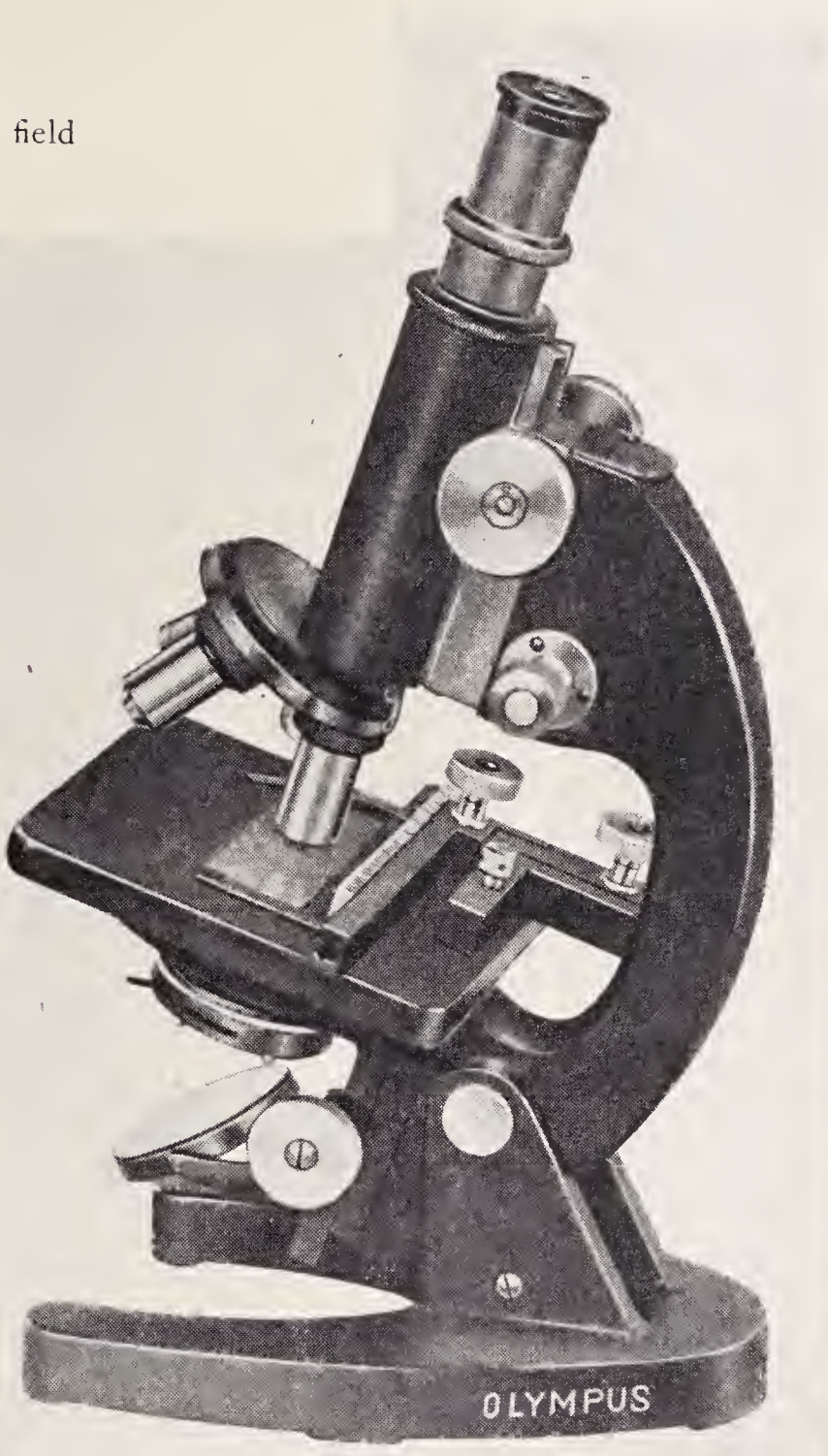

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MODES OF ISSUE:

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Thiamine HCl.	1 mg.
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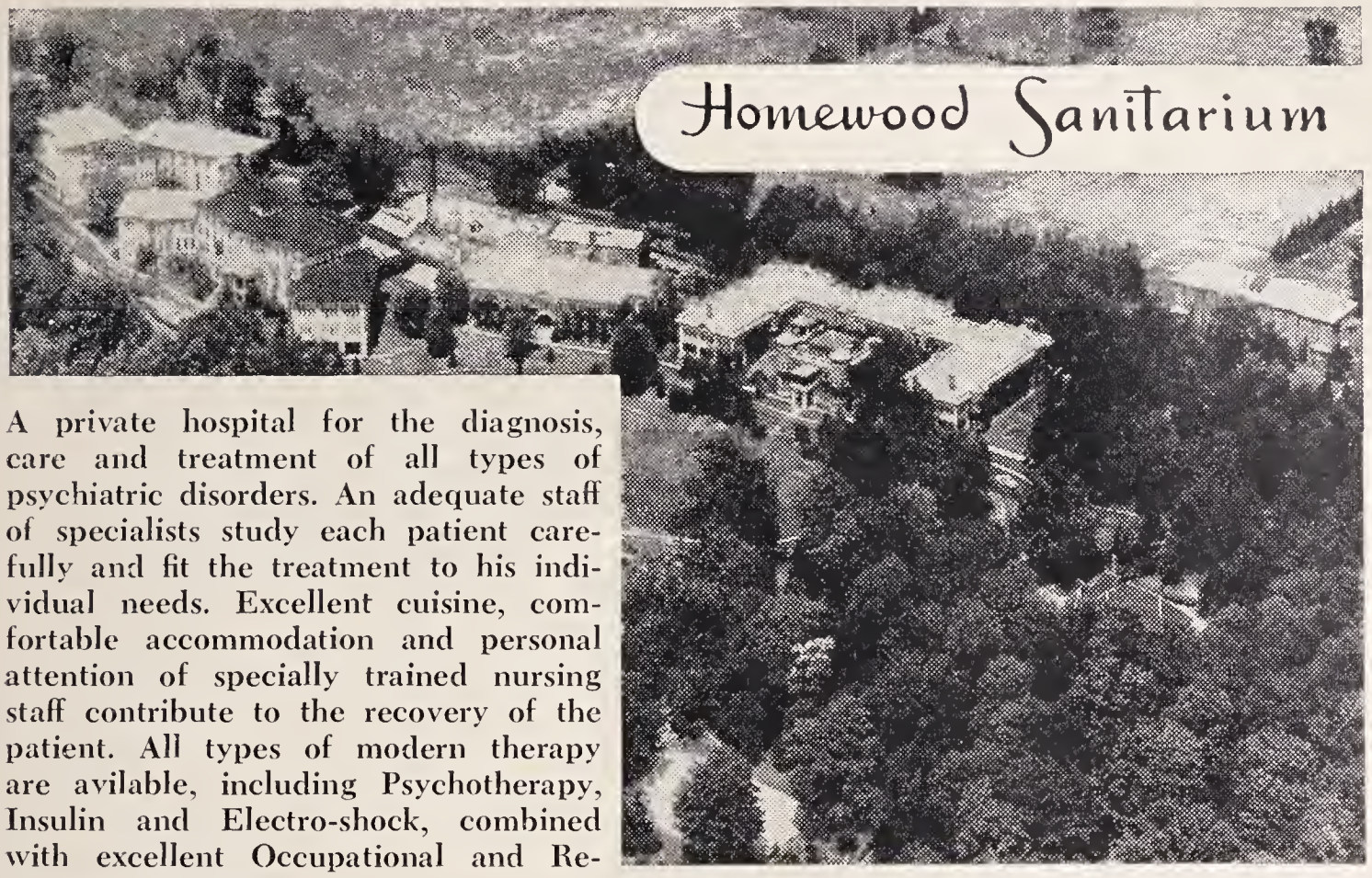

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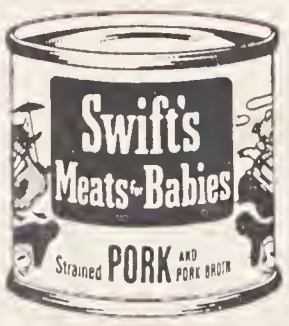

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